OUR INDUSTRIAL WORLD

J·RUSSELL·SMITH

Grade IX
Acc. Lib

Fig. A. USING THE EARTH—A PAGEANT OF HUMAN PROGRESS. This picture suggests our industrial world. You will find here something about the development of many things of which you will read in this book.

Our Industrial World

BY

J. RUSSELL SMITH, Ph.D., Sc.D.

Professor of Economic Geography, Columbia University

Author of

"Home Folks," a Geography for Beginners; "World Folks"; "American Lands and Peoples"; "Foreign Lands and Peoples"; "Human Geography," Books I and II; "North America."

INTERNATIONAL PRESS

THE JOHN C. WINSTON COMPANY

CHICAGO PHILADELPHIA TORONTO

ATLANTA SAN FRANCISCO DALLAS

TO TEACHERS

SOMETHING NEW

This book presents a new feature in elementary geography. The concept of *world regions* is here presented in a more accurate way than has previously been done in elementary texts. On the climatic-regions map (pages 2–3) the climates of the world are separated into a number of types. The map shows the parts of the world in which each type is located. This map will be a great aid in putting order and meaning into geography. This map is also a distinct stimulus to *geographic thinking*.

I predict an important future for the climatic-regions map in the study of geography on several levels. Climatic-regions maps have been in use in Europe for a long time. A map much like the one on pages two and three was published some thirty years ago by that first British geographer of his generation, the late and much lamented A. J. Herbertson.

ITS RELATION TO THE NEW GEOGRAPHY

In *this* volume climatic regions are not the basis of organization, but are a new tool useful in explaining the facts of geography. Explanation has become much more important since geography is recognized as a study of the *relationship* of *man* and the *earth* on which he lives.

SINGLE CYCLE—PLUS SERIES

Our Industrial World is the capstone of a single-cycle series. The other books in the series are Home Folks, a study of home geography in the United States; World Folks, a study of life in typical environments at home and abroad; American Lands and Peoples; and Foreign Lands and Peoples. These last two books present in detail the peoples and countries of the world.

After this thorough once-over, the question of how best to organize material for a final survey confronts the author. Time has brought students of earlier books to a more advanced stage of mental development. Students who use this book need to see many *old facts* in *new relationships*. How shall familiar material and the new material be organized to attain this end?

THE PLAN OF THIS BOOK

In Our Industrial World, as in all geography, we wish to have unity and we also wish to avoid unnecessary repetition. Therefore in this book we study the world by studying *world industries*.

WORLD INDUSTRIES AND WORLD REGIONS

If we follow the usual method and study the earth by countries or by continents, we find that wheat, for example, requires a major treatment in the United States, another in Canada, another in Europe, another in Argentina, another in Australia, with minor treatments in India, China, Turkey, and South Africa. Each area is taken up at a different time and without connection with the others. This method may be good for the first going-over of the world, but it becomes irksome repetition in a review.

On the *world industries basis*, as followed in this book, we have *one* presentation of wheat. First, the characteristics of the plant and the climates it needs. These facts are made clear by the world-climate maps. The maps enable us to compare the different regions and appreciate the importance of wheat, not to one country only but to the human race.

THE PLACE OF THE UNITED STATES

Using this topic of wheat as an example of the presentation by world industries, we first study wheat in the United States. Immediately thereafter we study wheat in other countries and continents. Thus we appreciate the true place of the United States in the world with regard to wheat.

UNITY A NECESSITY IN GEOGRAPHY

This study of world industries with the aid of the map of world-climatic regions aids greatly in one of the most difficult problems in the teaching or the writing of geography. *We must deal with many facts.* When we have finished do we leave in the student's mind bewilderment of unrelated and soon-to-be-forgotten facts or have we taken groups of facts and created from them a sense of unity?

In the search for *areas* having unity, one

P-8-35

so-7

TO TEACHERS

finds that any *continent* has almost as many different kinds of land as the world itself. Again, almost any country has so many kinds of land and so many kinds of human situations that one can rarely say anything that is true about the *whole* of any *country*. The same is true even of most of our American states. Within the boundaries of the state of New York is level, sandy Long Island with its semi-marine climate and a growing season 190 days long, and the Adirondacks with deep snow, sub-zero weather, and a growing season less than 90 days in length.

But the spring-wheat regions of Dakota, Manitoba, Saskatchewan, Southeastern Russia, and Western Siberia are strikingly alike. The winter-wheat regions with the Mediterranean climate in seven continents are also strikingly alike.

TYPE STUDY

This study of world industries with the aid of the world-climatic-regions map is *type study* in its widest application.

THE WEALTH OF MATERIAL

Please glance through the Table of Contents on pages v–vii. It shows what I mean by a wealth of material. The world is so big, there are so many interesting and useful things in it, there are so many countries to be presented, so many peoples that we need to understand that I burn with the desire to make the book as big as a dictionary. The limitations of space which the school systems set demand rigorous limits. However, this preface will show you how to get access to the rest of the material needed for the more adequate presentation of geography for students of this grade.

One of the first impulses that urged me to make the book bigger than was possible was a desire to *restate* the things that it *discusses*. Even if that were desirable, space does not permit. This final survey volume *must* be written on the assumption that the student retains from his previous work in geography a considerable knowledge of the various countries and their industries. But, even if he does remember facts, a good student will often want to check the facts again because in this book he will be *seeing familiar facts in new relationships*. Therefore the use of a survey book such as this will be most effective if the student frequently consults the books he has previously studied. Thus he will be able to check up material to which this book refers, and *he will see the facts from a fresh viewpoint*. Seeing an old friend in a new relationship is a *very educative process*.

The consultive use of earlier books will require the use of the index. By this means the student will form an excellent habit of finding and using related material. Almost every subject, not fully treated here, is presented in one of the other books of the series, and also to a considerable degree in other single-cycle geographies. It is almost necessary that some single-cycle geography series, as well as encyclopedias and other reference books (page 374) be within reach of the student using the book. Consulting other books *stimulates thought* and will do much to fix the subject matter more permanently in memory.

THE STATISTICAL APPENDIX

Much thought and labor have been bestowed on the statistical appendix. It contains a great amount of material that can be used to illustrate the application of the geographic principles that are stated in the text. The wide-awake student should be able to find many useful illustrations there. Especially do I call attention to Tables 57 and 62 which are almost a volume in themselves. Table 71 has the material for a great number of climate graphs that will afford instructive comparisons.

THE IDEA OF DEVELOPMENT

To become acquainted with a country or an industry we should have some knowledge of the causes upon which its development is based. Therefore, beginning with the frontispiece, this book has in its carefully thought pages many accounts of the *development* of *industries* and of regions.

The greatest things that have happened to the human race in the past hundred years are the advances in science and the consequent development of machinery for production and transport. Industries which were local have become worldwide, and these world industries have developed world trade and world rivalries.

TO TEACHERS

REVIEW

In the latter part of the book in the study of trade are some review sections that are far reaching. Teachers are urged to use them carefully and to make similar questions that particularly fit the year's work done by the class.

ILLUSTRATIONS

The illustrations have been selected or made with great care. The one on page 78 represents three weeks of detailed work. Perhaps that is one of the reasons why no other book has such a map. Be sure that every pupil *sees* what every figure *shows* and knows the relation to the *ideas* in the text.

CONNECT GEOGRAPHY WITH LIFE

We live in a perfect flood of material that connects with the work of this year in geography. You should by all means get much current material and show its relation to the course. Nearly all *statistics* of *agriculture* are omitted from the statistical appendix because you can get the *Yearbook of the United States Department of Agriculture* free from your congressman or senator. Statistics of commerce, up to date and in useful detail, can be had from the *Yearbook of the Department of Commerce, Foreign Countries.*

A thousand illustrative facts about almost every industry in every country can be had from *The New York Times* daily. Wherever your school is located subscribe to *The New York Times* if possible.

The United States Weather Map, daily, 30 cents per month, should be had for at least the month during which you teach the chapter on Corn.

The books listed in appendix. As aids to teacher and students, I have put on page 374 a very carefully selected list of books for both teacher and student. The last list, the books of travel and exploration, reminds me of my youth in a *little red schoolhouse on a hill.* Thursday was the most important of the five schooldays because at noon the mailman left the *Youth's Companion* at the post office across the common. During the afternoon I diligently read it while pretending to study. I am still grateful to that kind teacher who pretended not to see.

In the list of books of travel, in the appendix, I have put some that are not only interesting to read, but that also give geographical background. If you cannot get all do not miss *Tschiffely's Ride, The Land of Feast and Famine, Young Fu of the Upper Yangtze,* and *Ho-Ming, Girl of New China.*

ACKNOWLEDGMENTS

It is a pleasure to acknowledge the help I have received in preparing this book.

Mr. Otis P. Starkey, of the University of Pennsylvania, has helped with the Climate Regions Map.

Dr. George J. Miller of the Mankato State Teachers College, Mankato, Minnesota, and editor of the *Journal of Geography*, read critically the first draft of each chapter of the manuscript and made cogent suggestions of great value in the final revisions.

I have also received many suggestions from Mr. Frank A. Krutzke, my able secretary, and from Miss Helen Piper, Elementary Supervisor, Lynn, Massachusetts. Miss Margaret A. Hitch has critically read the manuscript for factual content.

Dr. Helen Mackintosh, Supervisor Later Elementary Grades, Grand Rapids, Michigan; Mr. Ferris E. Lewis, Director of the Social Sciences, Fordson High School, Dearborn, Michigan; and Dr. Russell L. Packard, Head, Department of Geography, Concord State Teachers College, Athens, West Virginia, rendered valued assistance with questions, pupil-activity materials, and review exercises.

Miss Zoe Thralls, University of Pittsburgh, Miss Harriet Carter, Frick Training School, Pittsburgh, Miss Harriet Elliot, State Normal College, West Chester, Pa., Miss Ella Huntting, State Normal School, Jersey City, N. J., and Mrs. Alfred Harcourt, Riverside, Conn., made useful recommendations as to books for teachers and pupils.

I wish also to acknowledge the constant counsel and help I have received, from beginning to end of this work, from Henrietta Stewart Smith, my wife, a skilled teacher of the young, and from Mr. William B. Nichols, of the editorial staff of The John C. Winston Company.

J. Russell Smith.

Columbia University,
New York City.

CONTENTS

CONTENTS

sc-7

CONTENTS

SPECIAL MAPS

PHYSICAL AND POLITICAL MAPS

POLITICAL MAPS

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the following organizations who courteously permitted the use of illustrative material in this book. Numbers following the names of organizations refer to pages in the text.

Alaska Pacific Salmon Corp., 15
American Agricultural Chemical Co., 124
American and Foreign Power Co., 320
American Fur Breeder, 11
American Milk Goat Record Association, 116
American Museum of Natural History, 133, 203
Andrews Publications, 100
Angora Journal, 33
Baldwin-Southwark Corp., 256
Bangor & Aroostook Railroad Co., 124
Beckwith, Frank, and Santa Fe Railway, 290
Belden, Charles J., 21
Bogardus, James, 293
Brick and Clay Record, 197, 273
Bush Terminal Co., 338
California Fruit Growers Exchange, 137
Californians, Inc., 119
Canadian National Railways, 220, 223, 298, 299
Case Co., J., 125
Caterpillar Tractor Co., 55, 58, 59, 60, 61, 101, 122, 123, 126, 157, 221, 240
Chivor Emerald Mines, Inc., 245
College of Agriculture, University of California, 131
Comey, G. W., 200
Commonwealth Immigration Office, Australia, 133, 140, 266
Cramer Krasselt Co., 113
Cunard Steamship Co., 328
Czechoslovak Consulate General, 272, 273
Davis, R. H., 75, 195
Department of Interior, Ottawa, Canada, 17
Duluth Chamber of Commerce, 216
Field Museum of Natural History, 12, 219
Fulton Iron Works, 155, 156
Galloway Mills, 249
Georgia Marble Co., 244
German Tourist Information Office, 276
Goodyear Rubber Co., 261
Hamburg-American Line, 138, 163, 254, 257, 332
High Point Chamber of Commerce, 303
Hoefler, Paul, from *Africa Speaks*, 1, 4, 37, 171
Ingersoll Waterbury Co., 255
International Harvester Co., 171, 194, 196
Iowa State Agricultural Experiment Station, 110
Italian Tourist Information Office, 311
Japan Tourist Bureau, 93, 145, 177, 218, 251, 313
Johns-Manville Co., 243
Lexington Water Power Co., 302
Link-Belt Co., 224, 233
Lipton, Inc., Thomas J., 147
Long Bell Lumber Sales Corp., 54
May Hosiery Mills, Burlington, N. C., 250
Milham, Charles, University of Wichita, 73
Ministry of Agriculture, Republic of Argentina, 283, 315
Ministry of Foreign Affairs, Brazil, 102
Ohio Chamber of Commerce, 318
Oklahoma Extension News, 72
New Orleans Chamber of Commerce, 300
New York Central Railroad, 217
New York State Department of Agriculture, 127
New York Zoölogical Society, 187
Niagara-Hudson Power Corp., 317
Norfolk-Portsmouth Advertising Board, 180
Norwegian Government Railways, 13
Pan-American Union, 143
Patiño Mines Enterprises, Consolidated, 314
Pennsylvania State College, 69
Pomona Products Co., 151
Poultry Item, 109
Proximity Manufacturing Co., 287
Public Works Dept., Karachi, India, 190, 191
Reynolds Tobacco Co., 180, 181
Rockefeller Foundation, 239, 323
Rock Island Plow Co., 79
Scarlett & Co., William G., 97
Schneider, F., Lucerne, 38
Sellers & Co., William, 253
Smith, J. Russell, 71, 153, 162, 189, 195, 320
Social Trends in the United States, 192
Standard Fruit Co., 140, 163
Standard Oil Co., 301
Stirling, M. W., 4, 5, 186
Swedish American Line, 188
Swedish State Railways, 40, 308
Swift & Co., 281, 282
Swiss Federal Railroads, 307, 343
Tannin Corporation, 262, 263
Union Stock Yards, Chicago, 33
U. S. Bureau of Agricultural Economics, 30
U. S. Bureau of Animal Industry, 104, 184
U. S. Bureau of Chemistry and Soils, 201
U. S. Bureau of Fisheries, 13, 15, 16
U. S. Bureau of Plant Industries, 56, 170, 173, 193
U. S. Bureau of Reclamation, 159, 239
U. S. Department of Agriculture, 33, 105, 106, 107, 110, 114, 116, 117, 119, 120, 129, 131, 135, 158, 174, 176, 182
U. S. Forest Service, 42, 44, 45, 50, 53, 195, 322
U. S. Rubber Co., 160
U. S. Steel Corp., 214
U. S. Weather Bureau, 86
United Shoe Machinery Corp., 264
University of Illinois, 193
Walker-Gordon Laboratories, 112
Ward Baking Co., 278-279
Washburn Crosby Co., 64
Winston-Salem Chamber of Commerce, 182
World's Markets, The, 154
Zeiss, Carl, Inc., 306

The following copyrighted photographs are reproduced by permission of the photographers:

Brown Bros., 15, 111
Chambers, W. T., 30
Galloway, Ewing, 70, 117, 127, 149, 155, 188, 189, 198, 232, 243, 260, 264, 265, 266, 267, 268, 270, 271, 273, 284, 291, 304, 321
Holmes, Burton; Ewing Galloway, 267
Koenig, W. H., 95, 139
Press Cliche, Soyuzphoto, 288, 289, 310
Publishers Photo Service, 57, 166, 259, 283
Stoll, Bert, 236, 340
Thompson, William, 7, 10, 17, 33, 39, 46, 57, 90, 94, 98, 115, 121, 130, 154, 159, 170, 185, 202, 209, 246, 248, 289
Wide World, 297

Fig. A. A group of Pygmy bowmen in the tropical forest which is their home.

INTRODUCTION

WHERE IS THE LAND THAT FEEDS *YOU*?

> THINK THIS THROUGH. What workers may have helped in some way in producing the articles for my breakfast and in bringing the food to my table? What workers helped with the Pygmy's supper?

People buried in a great forest. The island of Papua, north of Australia (Plate II and Fig. 3-A), is about nine times as large as the State of New York, and is mostly forest covered. Papua is one of the least-known parts of the world. Two or three explorers have reported that tribes of little people less than five feet in height, whom we call Pygmies, live in the interior.

Recently, an American anthropologist went to visit the Pygmies. He had a hard time getting there. For several days, as he went upstream in a canoe, he passed through country inhabited by big six-foot Papuans, who, when they want a real feast, have the unpleasant habit of eating a man. Their country is also badly infested with malaria.

The anthropologist and his companions went on upstream as far as they could go in their canoes. Then they traveled for days in mountainous and totally uninhabited country. At last they found the Pygmies—many villages of them—living in the mountains at an altitude of 3000 to 4000 feet. Pygmies are of the Negrito race.

Stone-age farms. These people had never seen a white man nor had they ever traded with one. They had no goods whatever such as white men have—not even a glass bead, a piece of wire, a spool of thread, or a knife. They had no metal. They used, and still use, stone axes, stone knives, and rattan thongs.

These Pygmies are farmers. To make gardens the men chop down trees and burn them. They make a tight stake fence to keep out the numerous wild pigs. The women cultivate the gardens. Everyone works, and all share the produce. While

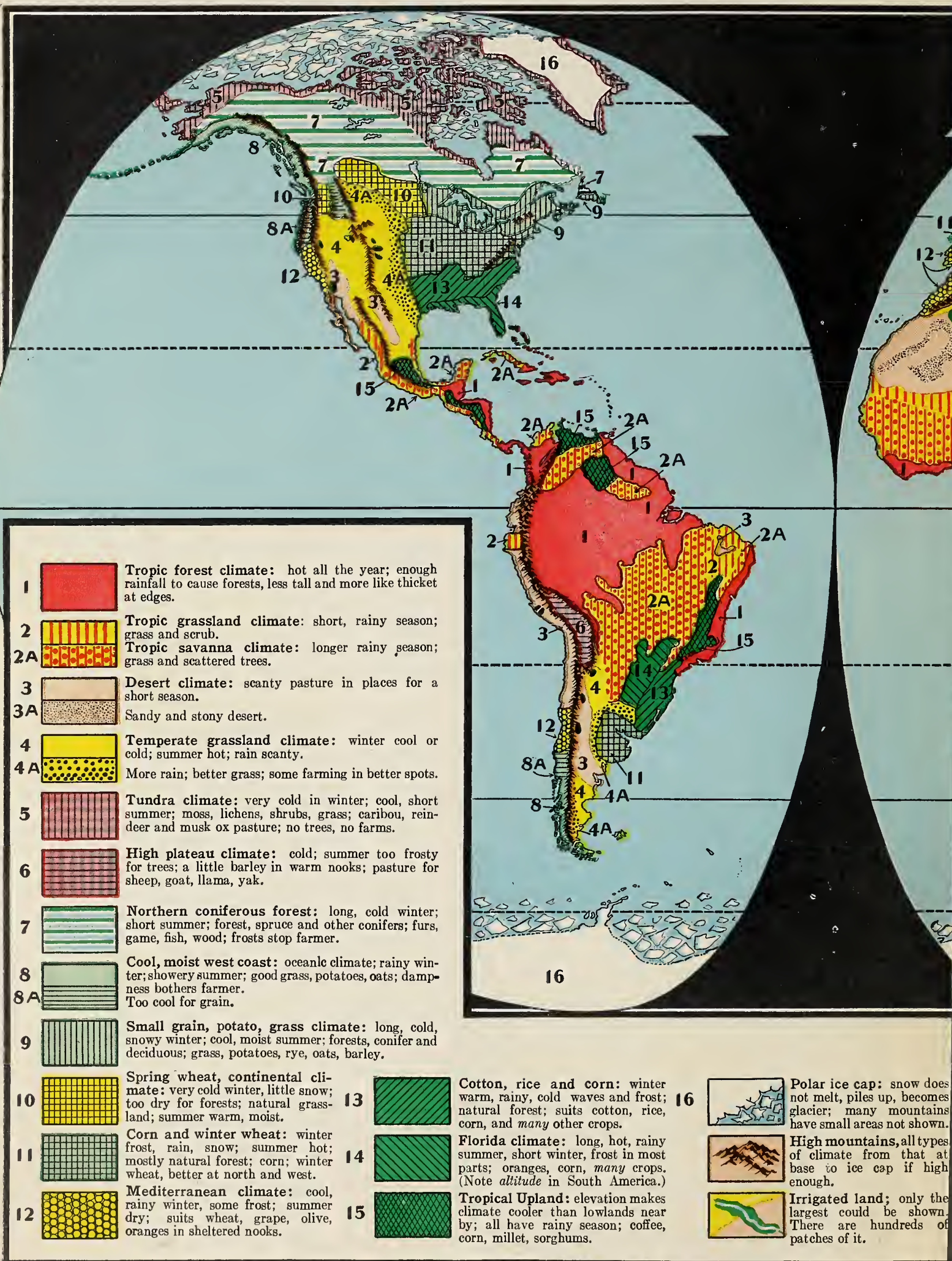
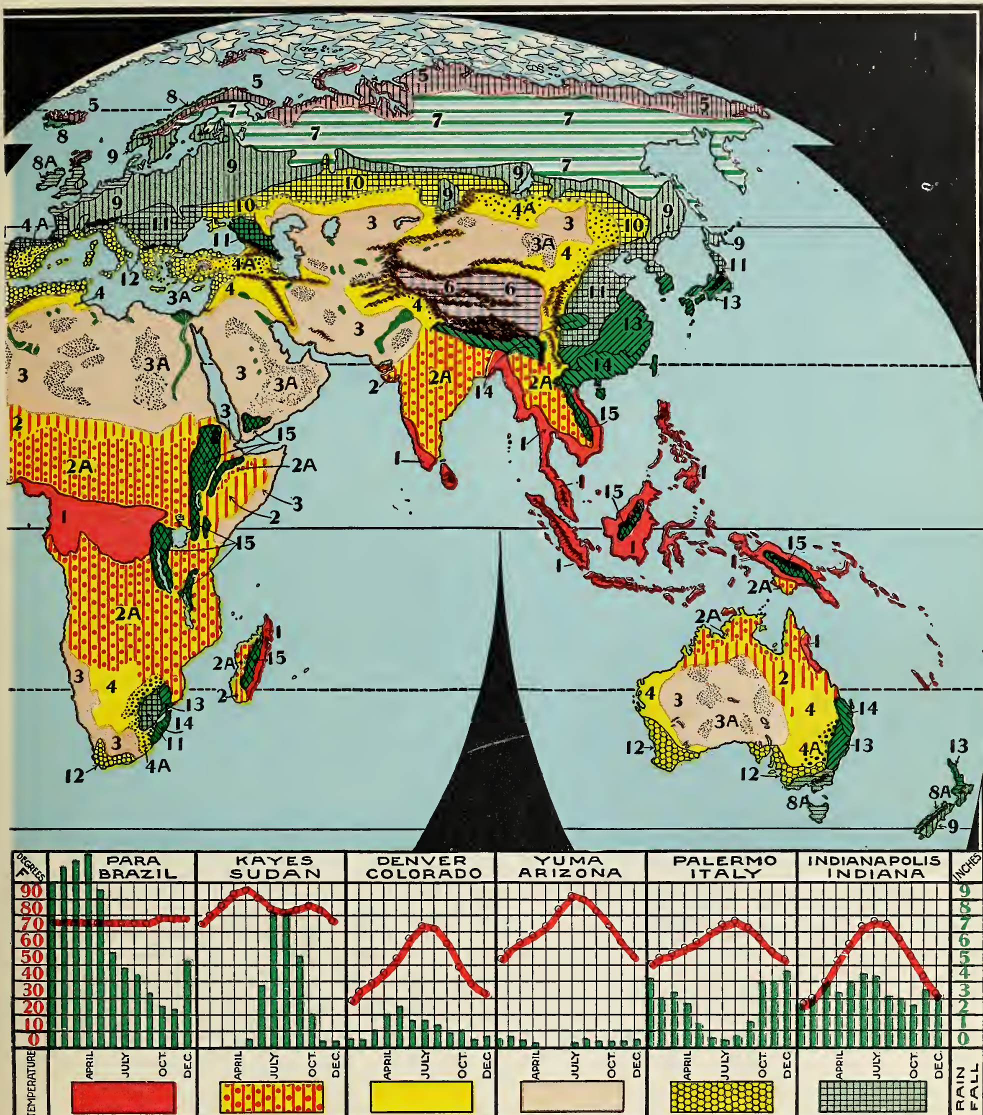


Fig. A. This map shows in a general



You will find this map of climatic regions very useful in the study of geography. You may say that it gives you geographic yardsticks with which to measure the world. For example, take the region marked 12. When you have studied one of them fully (probably California), you will know a great deal about each of the other five regions having the California (Mediterranean) type of climate. When you become familiar with the climate and occupations of one region, you know how man can use the earth in similar regions.

The six graphs in the lower right corner of the map may be called *pictures of climates.* The columns show the *average* amount of *rainfall* for each month at a particular place. See figures at right. Indianapolis has three and a quarter inches of rain in December. How much does Para have? ¶ The curved line crossing the graph shows the *average temperature* for each month. See figures at left. Para has a January temperature of 76° F. What has Indianapolis? ¶ Table No. 71 (Appendix) gives the figures from which you may make more graphs and thus make pictures of the climates in many parts of the world.

way the world's climatic regions.

Fig. A. The tall black fellow is less than six feet tall. How tall do you say the white man is? the Pygmy?

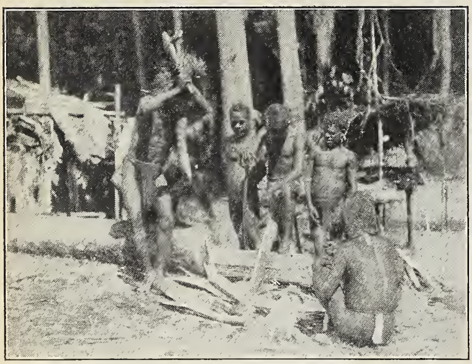


Fig. B. A camp of Pygmies in Papua. One of the men is splitting wood with a stone ax.

the white men stayed, the chief and his wife came to their camp every evening and gave to each of the visitors a share of the potatoes and bananas the women had brought in that day.

The main crop in their gardens is sweet potatoes. The green tops of the sweet potatoes serve as cabbage, lettuce, and salad for the Pygmies. They also grow taro (a vegetable much like the potato), lemons, bananas, tobacco, and sugar cane, which is their great delicacy. For meat, the forest gives wild pig and other game to the expert bowmen.

House, food, and clothes. The house of the Pygmies is made of split logs stuck upright in the ground like posts and covered with a thatch roof. There is no furniture whatever. The floor is entirely covered with bark, swept clean. In the middle of the floor is a bare place slightly sunken. This is the fireplace. Smoke goes out through the thatch. The women cook one meal a day, at evening. They wrap the pig, the potatoes, and the taro in green banana leaves and put them on hot stones. They cover the food with hot stones which they lift from the fire with wooden tongs. On the stones they put leaves, then more stones, and more leaves. The anthropologists say that this fireless cooker cooks the food very well.

It is the woman's job to cook the food. It is the man's job to bring in the firewood every afternoon. One afternoon the chief forgot his firewood as he sat talking in the white men's camp. His wife came and pulled his ear and scolded him roundly, whereupon he went and got wood for the fire. The Pygmies spend their evenings sitting around the fire roasting sweet potatoes and singing songs.

They wear no clothes except strings of beads made of seeds, and a very short waist covering made of the fibrous bark of an orchid plant. When the Pygmies travel, they carry with them bow and arrows, and over the shoulder they carry a bag of woven bark. The bag contains all the rest of their movable property—a stone ax, stone knife, a pipe with an acorn bowl, and tobacco. Sometimes they wear feather hats. In three days these men traveled as far as the white men had gone in a week.

Pygmy manners. The man-eating, six-foot-tall Papuans were noisy and rude. They stole things from the white men. The Pygmies were quiet, polite, and hospitable. They stole nothing. They kept every promise. They would take nothing for the food that they gave the white men,

and they gave every white man a present when he arrived. When the white men left, the Pygmies accompanied them several days' journey to the canoes. Upon hearing that the white men would never come back, the Pygmies stood with tears streaming down their faces as they watched their visitors depart.

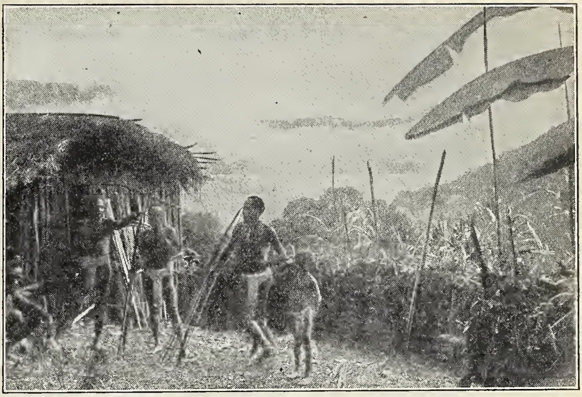


Fig. A. Pygmies beside their house in a forest clearing. Find in the picture a bow; a pig-tight fence; sugar cane; banana leaves.

Home space and sustenance space. The space where a man lives is his *home space.* The place that furnishes him the things he uses is his *sustenance space.* With the Pygmies, home space and sustenance space were both within an area of two or three square miles.

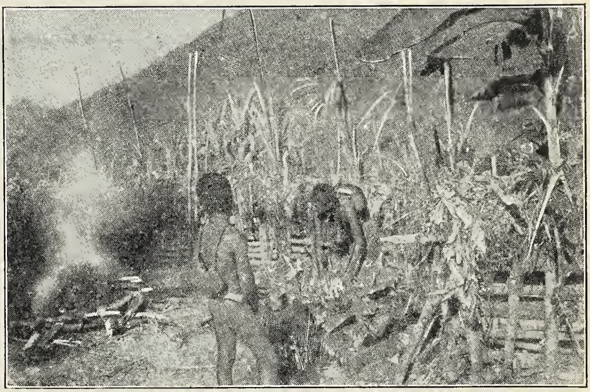


Fig. B. Pygmy woman building a fire to heat the stones to roast the supper. Name all the things which you see in the picture.

In the American colonies. In George Washington's time men long had had horses, cows, sheep, goats, hogs, poultry, metals, glass, many hand tools, wagons, and sailing ships. But the wagon could not haul much freight nor take it far. The sailing ship was slow and expensive. Therefore, in George Washington's time every neighborhood was almost a complete *sustenance space* of the people who lived there. From their home neighborhood the people got their food, the flax and wool for their homespun clothes, the wood for their houses and fireplaces. Local artisans made wagons, furniture, leather, and most of the tools. From distant places people received only a few things—salt, glass, a little iron for the local blacksmith, gold and silver, and for the few who could afford luxuries, there was a little spice, a little sugar, a little tea, and ornaments. These few things were brought from distant places, but, in the main, *home space* and *sustenance space* were still the same neighborhood, a matter of twenty or thirty square miles.

My sustenance space. This morning the bowl of fruit upon my breakfast table contained an orange from California and one from Florida; a banana from Central America; an apple from Virginia, and another from Washington State; a few grapes from California; and grapefruit from Texas.

My toast was made from Dakota wheat ground into flour in Minneapolis, Minnesota. The loaf of bread was baked in a huge seven-story bakery in a city some miles away. The bread was buttered with Wisconsin butter. I had an egg from Ohio, salt from New York State, pepper from the East Indies, bacon from Chicago, coffee from Brazil, and sugar from Cuba. My wife sipped tea from India, and my son had cocoa from West Africa.

Fig. A. Read again the section "My sustenance space" and then tell about this picture.

1. Rubber 2. Silk 3. Cotton 4. Flax 5. Wool 6. Coal 7. Iron 8. Lead 9. Copper 10. Zinc 11. Nickel 12. Aluminum 13. Gold 14. Silver 15. Platinum 16. Mica 17. Antimony 18. Hemp 19. Tin 20. Asphaltum 21. Shellac

The morning was cloudy, so the breakfast table was lighted with electricity brought by wire of Montana copper from a waterfall a hundred miles away. The telephone rang. As I picked up the instrument, I lifted a very complicated piece of machinery in which were used all of the articles (numbered 1 to 21) on the map at the top of this page.

My *sustenance space* includes every continent, dozens of countries, millions and millions of square miles.

I picked up the morning newspaper of December 20, the day I am writing this chapter. It gave news about Antarctica, Australia, Hawaii, four countries in Africa, eleven countries in Asia, nine in South America, nine in North and Central America, twenty-five in Europe, and six islands of the sea.

Our changing sustenance space. The Pygmies of Papua, living alone in their forest, know nothing of other parts of the world and get nothing from other peoples.

Settlers in the American colonies knew a little of other lands and peoples and exchanged goods to a limited extent.

Today we have knowledge of far-distant peoples and countries; the telephone, telegraph, and radio bring news of them every day. We receive their products and send to them goods that we have made.

Our country is related in a new way with all continents, many countries, and many peoples. Industries have become world industries. Trade has become world trade. This book tells about these world industries and world trade that have made this new and wonderful world in which we find ourselves.

THINGS TO DO AND THINK ABOUT

Use your imagination. Suppose you tried to live in your neighborhood without the use of metal. What changes would be forced upon you?

Sustenance space. 1. Tell about three kinds of sustenance space.

2. Tell about the sustenance space of people near your school; their food, clothing, building materials, house furnishings, tools, and toys.

3. Tell about the advantages of a small sustenance space; of a large sustenance space.

Fig. A. Hunting the emu in Queensland. This is one of the many clever ways by which the people we call savages get a living with poor tools. What does the man have in his hand?

CHAPTER I

HUNTING AND FISHING

UNIT 1—HUNTING AND THE FUR BUSINESS

> SOMETHING TO PROVE. Prove that fur gathering is the oldest and the newest industry.

The oldest industry. Deep under several feet of earth and rubbish on the floor of a cave in France, some men found the remains of fire, flint arrowheads, stone axes, stone knives, and bones that had been split by men to get marrow. Some of the bones were those of the reindeer, the wild horse, and other animals that lived in western Europe thousands of years ago.

These feasts by the fire in caves, in the long, long ago, resulted from hunting—man's first industry. The remains of man's work found in many parts of the world seem to prove that men lived by hunting for many thousands of years before they had domestic animals, gardens, farms, villages, factories, and stores.

Food gatherers. As a hunter, or *food gatherer,* man supported himself in all continents and in all climates. Sometimes he hunted animals for meat; sometimes he fished; often he hunted vegetable food—coconuts, hickory nuts, walnuts, acorns, fruits, roots, and seeds. The Indians of the Pacific coast stored their autumn supply of acorns, from which they made nutritious bread. The Indians of Alaska prized their store of smoked salmon, carefully prepared each spring at the time of the salmon run and put on high poles out of reach of wolves.

Hunting to get food and clothes. Men still hunt and fish as a means of livelihood in many kinds of climate. We are all familiar with the Eskimo and his ingenious life by the shore of the Arctic Sea. In the forests of central Africa and in several other places are certain dark-skinned tribes of Pygmies. In the edges of the Kalahari Desert of South Africa there are Bushmen. African Pygmies and Bushmen live by what they can shoot, dig, catch, or find. Negritos in the Malay Peninsula and in the Philippines, black fellows in the center of Australia, Punans in the interior of Borneo still get their food and clothes by

Key.—Where space permitted, names of fish were spelled in full. Where space did not permit, abbreviations were used. Key to abbreviations follows:

A—Anchovy
Bc—Barracuda
Bo—Bonito
C—Cod
F—Flounder
H—Herring
Ha—Hake
Hd—Haddock
H.M.—Horse Mackerel
Hl—Halibut
K—Kingfish
L—Lobster
M—Mackerel
Ml—Mullet
Mn—Menhaden
O—Oyster
P—Plaice
Pi—Pilchard
Pl—Pickerel
Po—Pollock
S—Salmon
S.M.—Spanish Mackerel
Sa—Sardine
Sh—Shad
Sm—Shrimp
So—Sole
T—Tuna
Ty—Tunny
Tt—Trout
Wh—Whitefish

Fig. A. This map shows where many different kinds of industries are carried on. Trace the journey that was taken by a whaling ship that sailed from Nantucket, Massachusetts, in 1820, and was gone three years. The whaler stopped at Rio de Janeiro; Capetown; Falkland Islands; Santiago, Chile; Hawaii; and San Francisco Bay. It also caught whales in Bering Sea before sailing back to Massachusetts. How does this voyage explain why New England whaling companies sometimes moved their home port to San Francisco or Seattle?

The southernmost post office in the world is on South Georgia Island (Plate II). It took nine months for a letter to go there and for the answer to get back. South Georgia is visited only by whaling ships that stop at the whaling station there. You will enjoy reading about this part of the world in the book *Whaling in the Frozen South.* You would probably enjoy reading about it more than you would enjoy doing it unless you are really fond of rough work.

Suppose you were a fur dealer and made a journey each year up and down the Mackenzie River in Canada. What does the climatic regions map (pages 2-3) tell you about the

kind of country you would pass through? The book called *The Land of Feast or Famine* will make you want to sit up at night to finish it, but you will probably not want to go to the places in the cold North that were visited by the man who wrote the book. But it will tell you many interesting things about the fur business of the Northlands.

Suppose you went inland from the coast of Labrador at the place where the word "salmon" is written on this map and came to the shore again on the Gulf of St. Lawrence opposite the island of Anticostia (Plate III). How long would the journey be? Suppose you went alone, in the winter time, with only a dog, a sled, a gun, some traps, some blankets, and such tools as you and the dog could carry. You live on what you can catch, you meet one family of Indians in all the journey, and you come out with a bundle of furs to sell. Men do make this hunting journey.

A very different kind of business is that of producing the fur called Persian lamb. That is the skin of a real lamb of the breed of sheep called karakul. See latitude 30° N. and longitude 60° E. What kind of country is it where you see the word "karakul"? You will read about that in the chapter on pastoral industries.

Examine carefully all the pictures in the chapter on hunting and fishing and then point out places where they were taken or where such pictures might be taken.

Trace the journey of a French fishing boat from the port of Brest (Plate XIII) to the North Sea; of another that dries some cod at Miquelon.

Trace the journey of a ship that goes out from an American port for a summer's salmon canning; also one that goes out from a Japanese port for the same purpose.

Trace two different journeys for a sealing ship.

Point out parts of the world that may be good places for fur farmers; poor places for fur farmers.

Figs. A-B. The picture at the left shows natives using a blowgun in the Malay forest. A tiny dart blown by man's breath, as boys blow paper wads through a tube, carries a stupefying poison. In a short time the bird or animal that has been struck falls down in a stupor. The forest drug hunter must have searched long to find this poison. ¶ At the right is a fish trap in Tanganyika, East Africa. It is one of the many ways by which primitive man catches fish. How does the trap work?

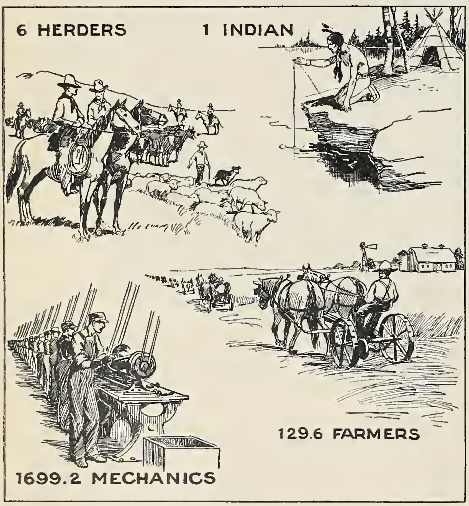


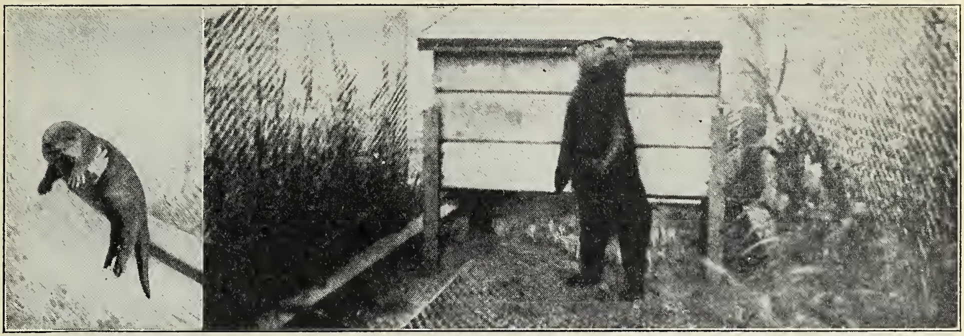
Fig. C. About 3 square miles were required to support the American Indian. Basing our calculations on the populations of Idaho, a typical herding state, Iowa, a typical farming state, and Rhode Island, a typical industrial state, we find that the same territory will support (in round numbers) 6 herders, 130 farmers, and 1699 industrial workers.

this ancient method and have little or nothing to do with the white man or with his goods. Some use the bow and arrow; others dig pits into which animals fall; some use the blowgun (Fig. 10-A), the club, and the boomerang. Still others make fish traps (Fig. 10-A), nets of sinews, and hooks of bone.

The Eskimo hunter lives chiefly on meat. The hunter in the tropical forest eats much more vegetable matter—fruit, nuts, seeds, and roots.

Sparse population. Many acres of land are required to feed a family where nature produces the food and people live by hunting and fishing. Therefore the population is sparse. These people usually live in single families; although, if the fishing is good, there may be a village. Sometimes many families of hunters come together for a short time to get game by great drives. In these drives scores of men surround a large territory and drive the animals to one place, where they may be shot from ambush.

Hunting as a money-getting business. In many parts of the world men now hunt animals and birds not only for food or sport but also to get something to sell for



Figs. A-B. At the left is a baby otter in the hand of a fur farmer. Many animals become completely tame if treated kindly by man from birth. At the right is a fisher in his Alaska fur-farm home.

money, just as other men receive wages for their jobs. Hunting elephants to get ivory—the great tusks of the elephant—was carried on so extensively that elephants have been exterminated over large areas of Africa and Asia. Hunting animals to obtain their furs and skins is the greatest hunting business in the world today.

Furs. Men have prized furs ever since they lived in caves. For many centuries the fur hunter worked through the Taiga, the great forest region from Finland to Kamchatka (Fig. 3-A), just as he now does in the Great Northern Forest of America. The furs from the Taiga were sold at the Russian fairs, and at the great fur market in Leipzig, Germany.

Soon after the discovery of America the Indian learned that he could exchange furs for white men's goods. The Indian trapper, with a bundle of furs on his back or in his canoe, made long journeys from the far interior to the inland trading posts of the white trader. From these places the white trader took the precious furs to New York, Boston, Montreal, New Orleans, or St. Louis. Most of the furs finally reached Europe.

Fur trade and fur markets. Today the largest number of furs and skins comes, not from the Great Northern Forests of Eurasia and North America, but from the Mississippi Valley. The intermingled farm, woodland, thicket, swamp, and stream are the natural home of such smaller fur-bearing animals as the fox, muskrat, skunk, raccoon, and opossum. The estimated average annual catch in the United States is about 11,000,000 muskrats, 7,000,000 to 8,000,000 skunks, and more than half a million raccoons.

St. Louis has naturally become a great primary fur market—a market to which raw skins are shipped direct. Here the United States Government sells its annual harvest of 50,000 sealskins from the Pribilof Islands in Bering Sea (page 18). Other markets are Kansas City, Chicago, Minneapolis, St. Paul, New Orleans, and in Canada, Montreal, Winnipeg, and Edmonton.

The Russians are trying to capture the former great fur trade of Leipzig. Recently they held fur auctions in Leningrad, where they sold squirrel and ermine from the Taiga, pony skins from the steppes, and Persian lamb from the government-operated farms of central Asia.

Nearly all the furs of the world finally get to London and New York, because these two cities are the great centers of finance, style, wealth, and of the clothing trade. At either of these two cities you may buy African leopard, Australian kangaroo, South American chinchilla, beaver and otter from Hudson Bay, ermine from Siberia, seal from both polar regions, and many other kinds of furs.

Fur farming. Steel traps, firearms, and high prices have caused a decline in the

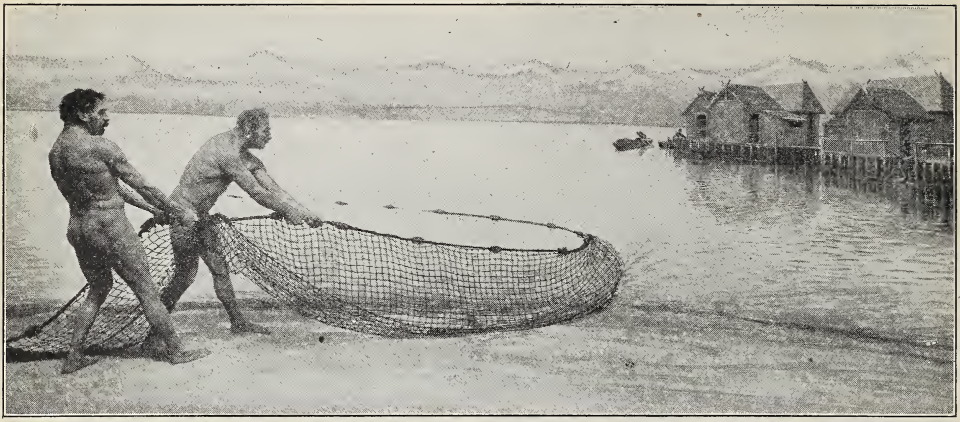


Fig. A. Men fished this way beside the lake villages on the Swiss lakes thousands of years ago. Why did they live over the water?

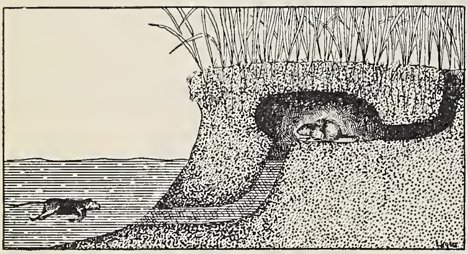


Fig. B. What are the advantages of this house to the fur farmer? to the muskrat? What does the farmer think of it?

number of fur-bearing wild animals in nearly all countries. In order to procure more fur, men have gone in for fur farming. Nearly a fifth of the Canadian output is now produced by this means. Fox farms lead, but some men have farms for raising muskrats, beavers, raccoons, skunks, martens, minks, and many other fur-bearing animals. Fur farming is a new business about which much is yet to be learned.

The raising of muskrats (musquash) on fur farms has several advantages and one disadvantage. The muskrat is a vegetarian, therefore his food is cheap. His flesh is edible for humans. He has two or three families a year. And he builds his *own* house safely out of sight underground, with the door hidden under water. But to keep him from getting away is not easy.

THINGS TO THINK ABOUT AND TO DO

Location exercises. 1. On a large wall map or a map in your book locate:

(*a*) Leipzig, London, St. Louis, New York, Montreal, Winnipeg, and some other fur markets.

(*b*) Three large fur-producing areas.

2. Your book tells of peoples who gain their living by hunting and fishing today. How many of these peoples does it name? Find the regions where each of these peoples live.

Checking your reading. 1. How did primitive man secure his food and clothing?

2. Do we depend on hunting and fishing for food and clothing today?

3. What are some of the primitive methods of hunting and fishing?

Problems for those who like to think. 1. Why are people that depend upon hunting and fishing usually few in number?

2. How did life in the colder climates make men more resourceful?

3. Why has modern man resorted to fur farming?

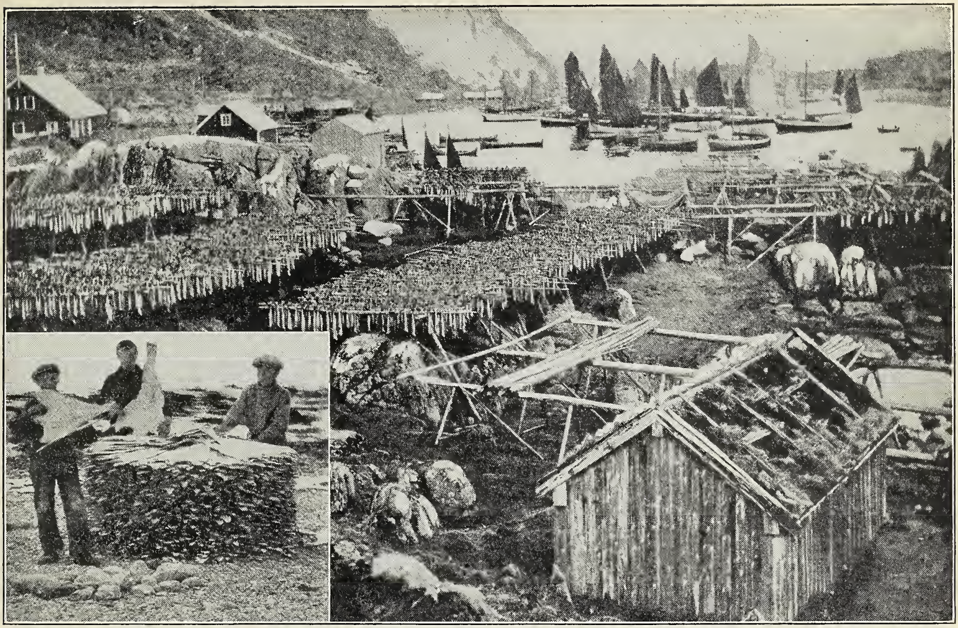
4. Why does not the Southern Hemisphere produce as many furs as the Northern Hemisphere?

5. Show how the habits of different animals make different problems for different kinds of fur farms. Compare the cost of keeping meat eaters and grain eaters.

Things to do. 1. Collect pictures that show animals whose skins are used for furs.

2. Have class discussion comparing devices used by primitive man with those used by hunters and fishermen. Have these things had any influence on the *number* of people who make their living by hunting?

3. What articles can you name that are made from furs or skins?



Figs. A-B. Codfish drying on racks near a fishing village in the cool land of north Norway. The boys in the smaller picture are stacking dried codfish awaiting shipment.

UNIT 2—FISH AND FISHERIES

> Conservation. Conservation is to save, to use wisely, and to increase if possible. What should be done to conserve the world's supply of fish?

Another ancient industry. Fishing is as old as hunting. It helped to keep the human race fed and clothed in the days before farming and flocks (Figs. 10-B—12-A). Today fishing is much more important than hunting. There is no other produce from 143,000,000 square miles of sea, or nearly three fourths of the surface of the globe.

Pastures of the sea. The sea water may look clear, but sometimes it teems with life. Microscopic plants of many kinds, called *plankton,* support, directly or indirectly, all the animals of the sea. In some places as many as two hundred little one-celled microscopic plants, named *diatoms,* have been found in one drop of water. In other places not a single diatom is found to the drop. When diatoms die and sink, their tiny remains make an ooze on the sea bottom. But countless billions of them are eaten by many forms of animal life.

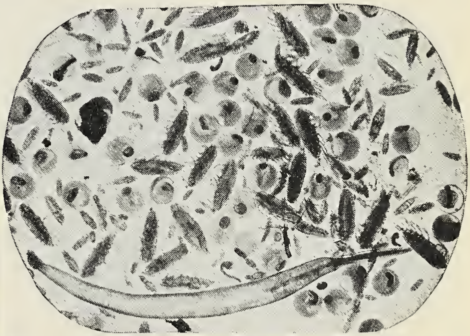


Fig. C. Read the section "Pastures of the sea" and then tell about this drop of sea water which has been photographed under a microscope.

A small sea animal about an eighth of an inch long, called the *copepod,* lives on plankton. Copepods are very abundant in some places. The herring fishermen call them "red feed." Some zoölogist discovered

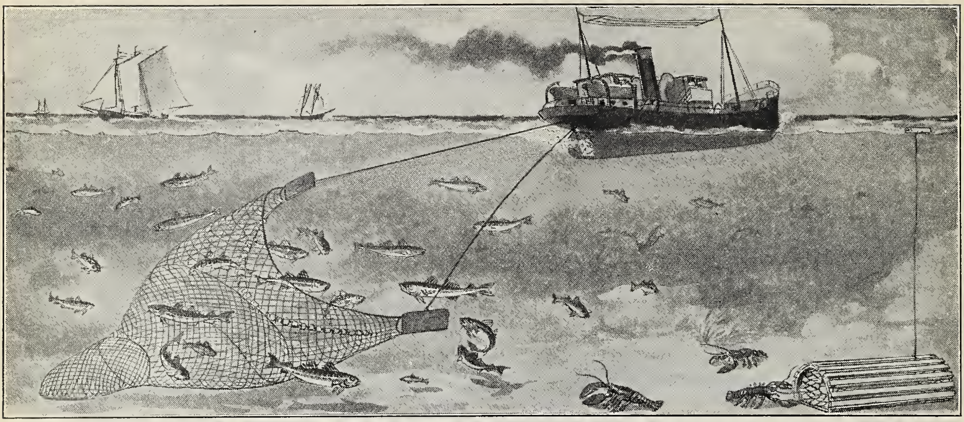


Fig. A. After you have read the section "Fishing banks," tell about this steam trawler and its trawl net.

that in the English Channel an extra amount of sunshine in February means large quantities of diatoms. These supply food for an unusual number of copepods in May, which in turn feed more than the usual number of mackerel in June.

Many fish swim with open mouths. Water goes into their mouths and out through their gills. The gills are like fine nets, through which the fish strain the water and so get small plants and small animals to eat.

There is some fishing on almost every seashore, but the heat of tropic climates spoils fish so quickly that tropic fishing is of little importance in *commerce.*

The rich North. If you dip a net beside a coral reef in some tropic sea, you may get many species of small animals. If you drop it in the Arctic, you may get ten times as many animals, but only one tenth as many species. It seems strange that the cold Arctic and sub-Arctic waters are richer in the quantity of plant life and of animal life than are the warm waters beneath the tropic sun. James Johnstone in his book, *Conditions of Life in the Sea*, quotes the scientist Kjellmann as saying, "One stands as before an insoluble problem when he makes a haul with a tow net in the Arctic, and obtains abundant and strong vegetation, and this at a time when the sea is covered with ice, the temperature is extremely low, and nocturnal gloom predominates even at noon."

Fishing banks. The shallow waters along the Atlantic coast of North America are called the *Continental Shelf.* If the water in the northern oceans is only fifty or one hundred feet deep, crabs and many other little animals can live upon the bottom. The valuable fishes that we call cod, halibut, and haddock come to eat these little fellows. Then along comes man with his baited hook to catch the cod, the halibut, and the haddock.

For a long time man used only the long line, or trawl, with many baited hooks to catch fish. But recently he added the steam trawler, whose powerful engine drags a wide-open net along the sea bottom.

Fisheries in northwestern Europe. In the shallow waters of the English Channel, the North Sea, along the coasts of Norway, The Faeroes, and Iceland are some of the richest fishing grounds of the world. By agreement among the nations, that part of the ocean more than three miles from land is *international;* that is, it belongs to every man and every country. This rich fishing ground of northwestern Europe has helped to feed many generations of Norwegians, Danes, British, and Dutch. It has also given them an export.

In cool climates codfish may be dried. Dried cod is about as hard as a board, keeps almost as well, and can be taken to hot countries. A recent traveler reported that dried codfish was sold by the ton at Elizabethville, a copper-mining town in the Belgian Congo, where about 4000 white people and 30,000 Negro natives lived.

For centuries the dried cod of northwestern Europe was shipped to the Mediterranean countries. To this day fish in bulk, canned fish, fish oil, whale oil, and fish meal rival forest products as the leading export of Norway. Fishing boats sail each season from Bergen and Stavanger in Norway; from Hull, Grimsby, and other ports in England; from Aberdeen in Scotland; from the Shetlands; from Nantes and St. Nazaire and other French ports; and from all the ports of Holland and Denmark.

The Grand Banks and fishing fleets. The really big news about the discovery of America was the report that there were good fishing banks along the coast. The report was true. The banks between Cape Cod and Newfoundland are as rich as those of the North Sea. Europeans fished here for a hundred years before they settled Canada. Since 1880 these banks have yielded a billion pounds of codfish each year. Scores of years before any European tried to make a home in North America, British, French, and Portuguese fishermen made annual journeys to the Grand Banks. These fisheries are still important to Europe.

France long ago lost her American colonies, but she still has two rocky little islands, St. Pierre and Miquelon, near the southern shores of Newfoundland. These islands are little more than fishing stations, convenient to the Grand

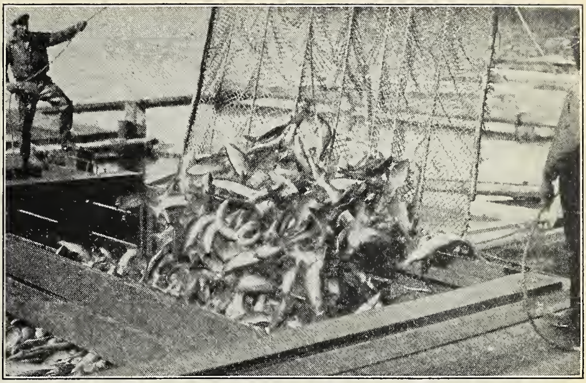


Fig. A. Mass production in a salmon cannery. Nets operated by mechanical power are dumped into a scow by mechanical power. What does this tell you about laws for the conservation of fish?

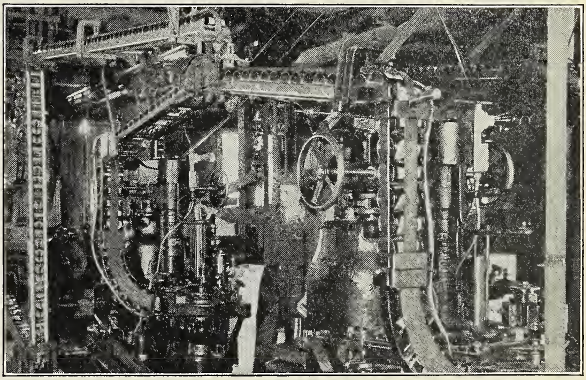
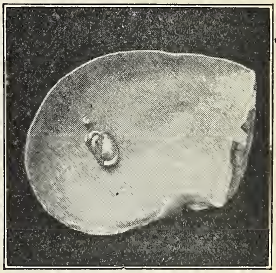
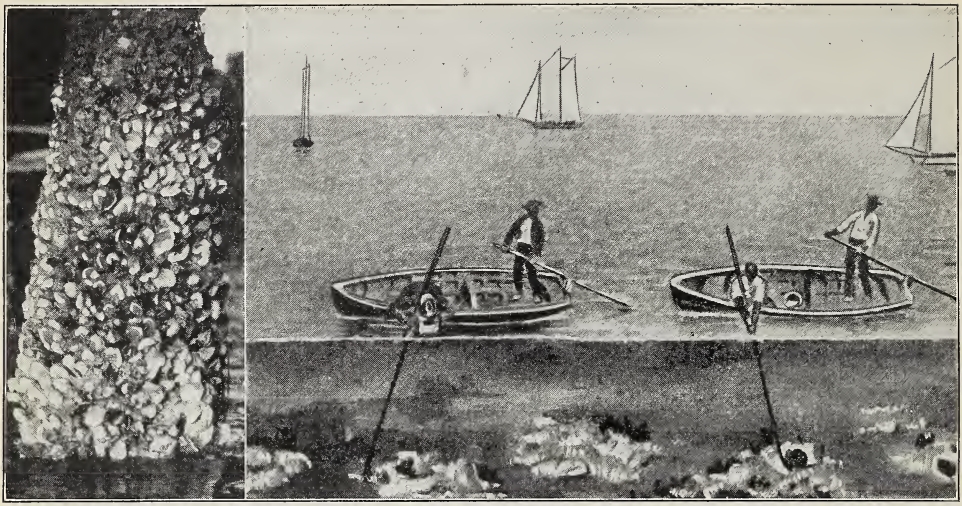


Fig. B. Mass production in a salmon cannery. This machine turns a bundle of tin plate into a carload of cans.



Figs. C-D. The picture at the left shows salmon eggs actual size in a fish hatchery. At the right is a shining pearl that has been prized for ages, and recently the pearl-covered shells common in many tropic seas and inland waters have become a raw material for button factories.



Figs. A-B. The picture at the left shows oysters sticking to a pile and exposed at low tide. Can you tell their life history? Why do oyster "farmers" put shells and branches of trees on the bottom of shallow waters and take them up again in a few years? ¶ The picture at the right shows sponge fishermen at work. The sponge, like a bunchy plant, sticks to the rocks until man tears it off with a hook or dives down to get it.

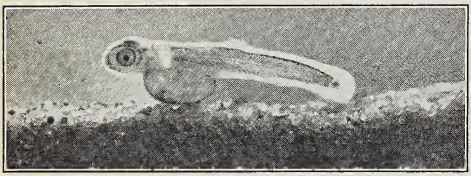


Fig. C. This tiny fish just coming out of an egg shows how much he needs the protection that he gets in a fish hatchery, where nothing gobbles him up while he is so little and slow.

Banks. By treaty France promises *not to fortify* these islands. They are part of her *economic* empire, but not of her *military* empire.

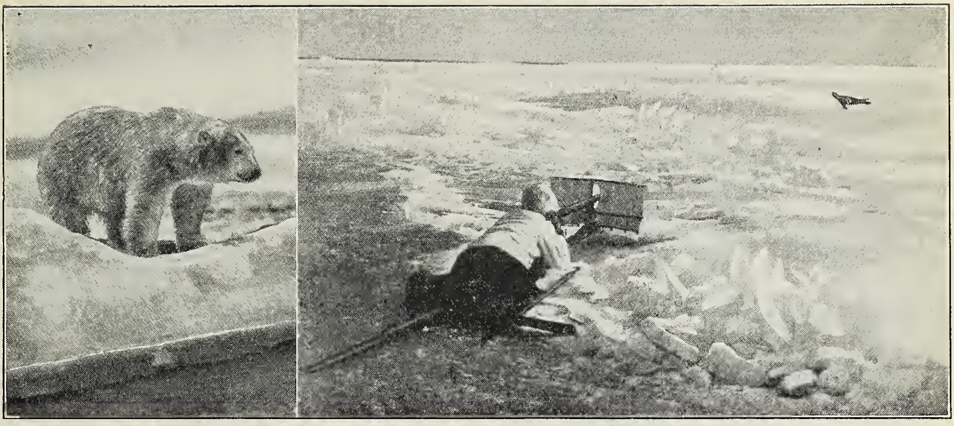
The fishing boats that work on the Banks play an important part in the life of St. Johns, Newfoundland; of Halifax and Yarmouth, Nova Scotia; of St. John, New Brunswick; of Gloucester and Boston, Massachusetts.

This fishing fleet was more important to New England and eastern Canada a hundred years ago than it is now. The dried fish which these countries sent to the Mediterranean region and to the West Indies gave the people a sure source of money at a time when there was little foreign market for anything their land produced. Through building and manning the fishing boats, the arts of shipbuilding and seamanship were mastered. Yankee fishermen invented the schooner, the fastest of all sailing vessels. A hundred years ago the ships (*clippers*) of New England were carrying on commerce to every continent.

The leading fishing countries of Europe—Great Britain, Norway, Holland, Denmark, France—have important fleets of merchant ships and have done much exploring. Fishing helps to build the fleets and train the men. It has been said that North Sea herring made the Netherlands a sea power and trained men for the British Navy.

The surface fish of the open sea. Some fish, such as mackerel, herring, bluefish, and menhaden swim near the surface and strain the water through their gills to get the little animals and plants that are their food. In April schools of mackerel are found off the coast of Virginia. By June they have worked as far north as the New England coast. Fishermen follow, catching them in nets.

The sea herring is very important in



Figs. A-B. The seal suns himself beside a hole in the ice. Man has copied the polar bear's trick of sneaking up on the seal. At the left is a polar bear on the Arctic ice. He is the most constant sealer.

Europe, both as a food supply and as an export for the Dutch, British, and Norwegians.

"Sardine" is a name applied to almost any small fish that is suitable for canning. Portugal, France, and California have important sardine canneries, as you may find by looking at labels on the cans in a grocery store. In Maine small herrings are packed as sardines.

Southern California, Sicily, and Sardinia have an important industry in canning the tuna, a fish that sometimes weighs a thousand pounds.

River fisheries. Some fish live in the sea but swim up rivers to lay their eggs. The river herring, or *alewife*, does this. It is caught by the million, especially in the Chesapeake Bay and the streams that flow into it. In the spring, shad, a most delicious sea fish, swims up the rivers of the Atlantic coast from Florida to New England.

Salmon are the most important of the river visitors. They are born in the cold waters of glacial lakes high up in the mountains, go down to sea in a few weeks, and return several years later having grown as long as your arm or even longer. Salmon are found on the coasts of Europe and eastern North America, but are much more important in the Pacific streams. Annually, tons of salmon go up the Sacramento, the Columbia, the Fraser, the Skeena, the Kuskokwim, the Yukon, and the rivers of Asia in the same latitude. For an unknown length of time salmon was the chief food of the Indians and the Asiatics along these streams.

Along many of the streams of the North Pacific stand great canneries, empty and idle, with only a watchman on guard in winter. In spring ships bring scores or hundreds of workmen for a busy season canning salmon.

Lakes and inland seas. The Caspian Sea has many sturgeon, a fish four or five feet long. Our own Great Lakes yield whitefish, trout, and perch.

Sponges and shellfish. Sponges are the soft skeletons of creatures that grow clinging fast to rocks at the bottom of the sea. They live in warm waters such as those near Florida, Cuba, the Bahamas, and parts of the Mediterranean Sea (Fig. 16-B).

As lions and cats are cousins, so are lobsters (big) and crabs (little). They crawl around the bottom of shallow sea waters, particularly near the shore. Lobsters are caught in a baited trap, a big slat box (Fig. 14-A). Lobster fishing is especially important in New England and eastern Canada, but, as is the case with many other

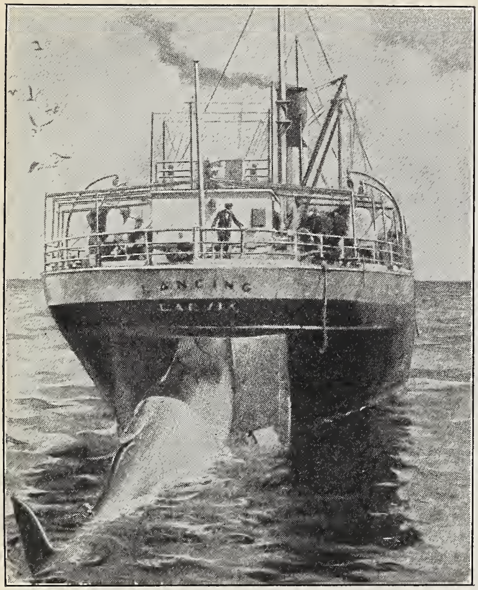


Fig. A. The recently killed whale is being drawn into the open end of this "factory ship"—a floating packing plant.

kinds of fish, so many lobsters have been caught that the supply is getting scarce.

Oysters lay eggs which hatch in the water. The baby oyster swims awhile, then attaches itself to some stable object (Fig. 16-A) and spends its life there, growing a shell and eating what the currents bring. Catching oysters is an important industry in Long Island Sound, Delaware Bay, Chesapeake Bay, the lagoons along the Gulf of Mexico, the English Channel, and the Bay of Biscay. Oyster farming (Fig. 16-A) is increasing in importance.

Clams inhabit cold waters. They are important for humans as food and as fish bait. Clams are much like oysters, except that they can move about for short distances.

Seals. The seal is not really a fish. He is a warm-blooded animal and is himself a fisher. But people commonly speak of seals when talking about fisheries. The seal likes icy water because he finds there plenty of shrimps, squid, and fish. The seal is covered with warm, thick fur and coarse outer hair and has a protecting layer of fat or blubber. These protections against cold are the seal's undoing. For example, each year a fleet of vessels sails from St. Johns, Newfoundland, along the coasts of Newfoundland and Labrador, to catch hair seals as they lie upon the sea ice along the shore at the beginning of spring. Men kill the seals with clubs, and finally the fleet comes back loaded with *sealskins* and with *oil* made from blubber.

Another species, the fur seal, has much finer hair and produces the valuable sealskin fur. A hundred years ago there were two great herds of these seals. One was in the Antarctic, and was virtually exterminated years ago. The other herd lived on one of the Pribilof Islands in the Bering Sea. This herd was almost completely destroyed because men can shoot the seals as they swim to and from the islands, where their young are born. Finally the seals were saved by a treaty between the United States, Canada, Japan, and Russia. The United States Government owns the seals, kills some surplus males each year, but gives a part of the skins to Canada and Japan, because the subjects of these nations no longer shoot the seals at sea.

The elephant seal, largest of the seals, breeds only on one small group of islands off Lower California, and was commercially exterminated a century ago.

Japanese fisheries. Japan has more than four persons for every acre of cultivated land on her more than thousand islands. She does not have room to grow feed for many pigs, sheep, cows, and beeves. So the Japanese people eat less meat and more fish than any European people. The people of the United States, on the average, eat one hundred thirty-three pounds of meat each year; the Japanese eat three pounds. We eat fifteen pounds of fish; the Japanese eat more than fifty pounds, including whale meat.

Japan has a large fleet of fishing boats of many kinds, from whalers to rowboats. The northern part of Japan has waters and climate much like those of New England

and Nova Scotia. Her fisheries also resemble those in that part of North America. There are also salmon in the rivers from the Amur northward. The Japanese can salmon as we do. One of their exports is giant crabs caught in the cool waters along the coast of Asia. More than 20,000 Japanese fishermen work along the Siberian shores.

Mackerel and herring are caught off the coast of Japan as they are off the coast of the United States. The Japanese have many other kinds of fish which we do not have.

The whale. Some whales are nearly a hundred feet long, weigh 150,000 pounds, and are said to be the largest animals that ever lived. There are many species—little, middle sized, and big. Whales live in all oceans from the icy Arctic to the hot equatorial waters. Many of these species are nearly extinct, so fiercely have these warm-blooded, blubber-covered, swimming animals been hunted.

In the days when the tallow candle was the chief source of light, whale oil for the family lamp was a prized luxury. In those days the whalers (sailing ships) of Nantucket and New Bedford, Massachusetts, sailed on voyages of from one to three years. During a voyage a whaler might visit every ocean and return with its holds full of barrels of whale oil and a few tons of precious whalebone.

In those days, when the lookout man on the masthead spied a whale, a small boat was launched. When the boat came near the whale, a man in the bow threw the harpoon (a spear with a rope attached) into the whale. Nowadays men shoot whales with a cannon, so the whale has no chance at all.

The Norwegians do most of the world's whaling. Their ships go to the Arctic, the Antarctic, and the North Pacific. Their land stations are situated at South Georgia in the Antarctic, on the southwest coast of Africa, and in many other places.

In 1932 the United States and twenty-five other nations signed at Genève a treaty for the protection of whales. With his flesh good for food, his blubber good for oil, his skin good for leather, the whale needs to be protected by international treaties. Otherwise these great natural wealth creators would all soon be killed.

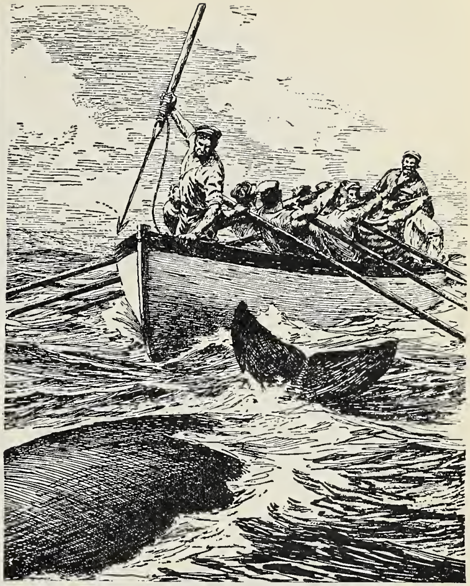


Fig. A. Find on this page a paragraph which describes this picture.

Fish culture. In China, Japan, and Europe fish are reared in ponds very much as we rear animals in fields.

Sea resources for the future. We know comparatively little about the sea and its life. If we knew more, the sea might be of greater use to us. For example, the airplane makes it easier for us to find those places, sometimes several square miles in extent, where fishing ships might do as the whales and mackerel do—scoop up quantities of little animals or fish. These fish could probably be made into human food in some form. If not, they certainly are good food for chickens and pigs, and for plants in the form of fertilizer. Menhaden, not good for food, and fish waste are used for fertilizer in Japan and the United States.

Fig. A. Density of population throughout the world.

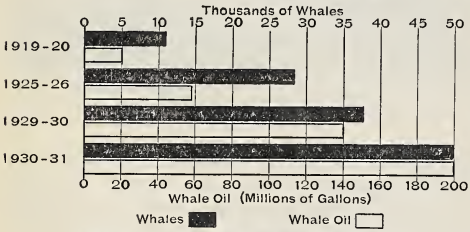


Fig. B. Tell what this graph shows.

Fish meal has for many years been a standard food for some live stock; we should have much more of it. There should be several ships with scientists aboard studying the ocean and its contents all the time.

THINGS TO THINK ABOUT AND TO DO

Things to do. 1. Tell the class the life story of a salmon; of a seal.

2. Collect pictures of fish used for food. Paste these pictures in your geography scrapbook.

Checking your reading. 1. How did a treaty save the fur seals?

2. Upon what source do fish depend for their food supply?

3. What fish live near the surface of the sea? near the bottom?

4. What other varieties of life does man get from the sea? Why is each caught?

5. Where are whales captured?

6. Where and how are oysters secured?

7. Where are the chief fishing grounds located?

8. What countries lead in the fishing industry?

Problems for those who like to think. 1. Fish is a chief export of Norway, Newfoundland, Nova Scotia, Alaska, and British Columbia. Tell the influence on this of kind of coast (smooth or full of bays), water offshore (deep or shallow), character of land (good for farming or rough and steep).

2. What laws has your state that protect its wild life?

3. Why are fish not so easily exterminated as fur animals?

4. England and Japan are two great fish-eating countries. Can you tell why?

CHAPTER SUMMARY

Getting a map in your mind. Take an outline map of the world and show on it

(*a*) all those areas where most of the things man gets are *wild things*.

(*b*) the areas that are best for fur farming.

(*c*) print in the names of the fish in the regions where they are secured.

(*d*) show also the main fur-bearing areas.

A picture-study contest. Examine the pictures in this chapter and select the one that tells you the most things. State briefly those things. Whose list is the longest? (Perhaps the class may be divided into teams for this.)

Problems for people who like to think. 1. In what ways does this chapter tell of your dependence upon other peoples? of their dependence on us? Are we worse off or better off for this dependence? Tell of some changes that would happen to them and to us if this dependence of one upon the other should cease.

2. "Fish helped to make Britain a sea power."

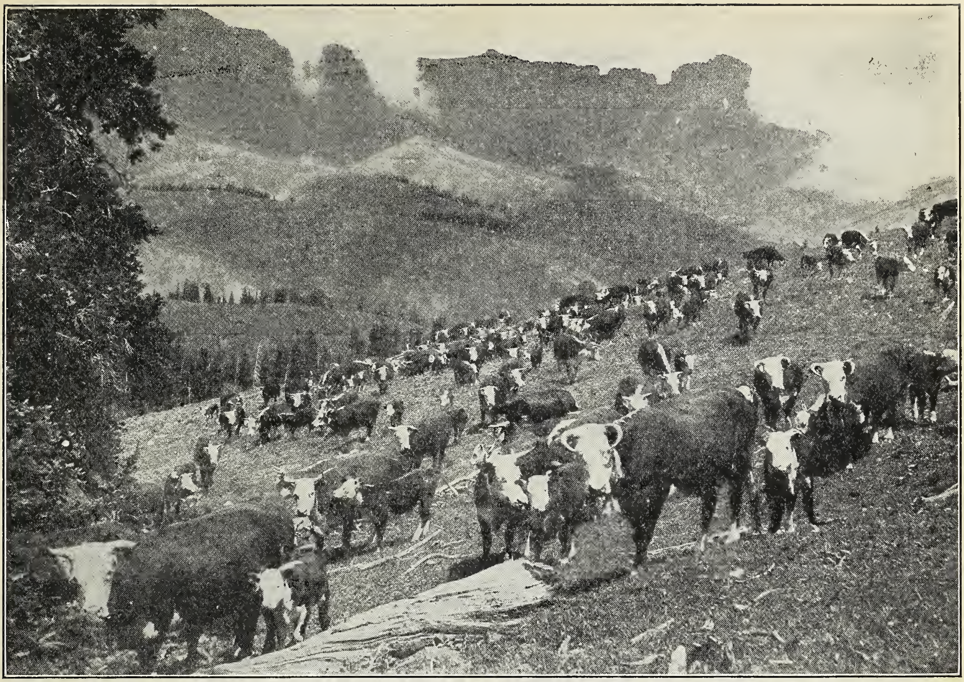


Fig. A. Beef cattle from the Great Plains of Colorado on a Rocky Mountain pasture near the timber line. At what season was the picture taken? What signs of forest fire do you see? Do you think this timber is valuable?

CHAPTER II

FLOCKS, HERDS, HERDSMEN, AND PASTORAL REGIONS

UNIT 1—THE BUSINESS OF FOLLOWING FLOCKS

WHAT DO YOU THINK? Who did the greater service to man, those who tamed animals or those who tamed plants?

Man tames animal helpers. Once upon a time, a long while ago, some hunter had a great ideȧ—one of the most useful ideas that ever came to man.

Said he, "Instead of hunting wild animals all my life, I shall tame animals and have flocks of my own."

He tried this plan and it worked. So the pastoral industry began.

Taming animals probably happened first in central Asia, where to this day there are wild horses, wild asses or donkeys, wild sheep, wild goats, wild camels, wild pigs, wild cattle, and other wild animals that man has not been able to domesticate.

At the earliest time to which we can give a date, man had tamed those animals. He has not tamed any important animals in the last 2000 years. But recently ostriches have been penned in fields to get their feathers, and fur-bearing animals are being kept behind fences in order to obtain their skins.

Man becomes a herdsman. It was a great step for man when he ceased to live by hunting and became a follower of flocks. His food supply was much more regular and he had new foods—milk, butter, and cheese. From sheep he had a regular supply of wool for making yarn and cloth. He could ride

Fig. A. Distribution of rainfall throughout the world from November 1 to April 30. The "wind roses" in the oceans show the directions from which the winds blow during December, January, and February.

upon the strong back of the horse or the ox. He could put his tents in bundles upon the backs of his animals. Then someone thought of dragging poles (Fig. 325-A). Later came the cart and wagon.

Sparse population of pasture lands. There cannot be many people to the square mile in areas where man lives upon flocks and flocks live upon native grass. If the soil and climate let man grow wheat or corn or hay, and man becomes a farmer and plows the land, he can get a great deal more produce from an acre, and many more people can live on a square mile. To do this man must continue to live in one place and he must work regularly.

In many lands for many centuries the free-moving herdsman on his horse has looked with scorn on the farmer walking behind his plow. But the plowman, since he gets a greater return from an acre, can afford to pay more for his land. Because of their greater number, plowmen can drive away herdsmen and use their land. Thus agriculture has taken the fertile lands and the area of nomad land has declined in the last hundred years.

Kinds of land. If land is suitable for cultivation, man uses it mostly for farming, but some land he cannot cultivate. There are several reasons for this:

1. Mountains make some lands too dry for farming;

2. Lands are made dry by the world wind system;

3. Lands are too rough, too wet, or too cold for farming.

THINGS TO DO AND QUESTIONS TO ANSWER

How animals help man. Name the ways in which each of men's animal helpers have been made to serve man. Bring pictures and put on the class bulletin board.

Questions to answer. 1. How did the taming of animals help man advance in civilization?

2. Why can few people live in grazing areas?

3. What changes has fencing made in the ranching industry?

4. Would you prefer to be a cowboy or live in town? Why?

A look at the past. What tribes of Indians lived in your state before the white man came? Did they tame any animals? What animals are native to your state?

Extra credit. Find the three parts of the world where pasture land has become farm land. Figure 2-A will help you to find the answer.

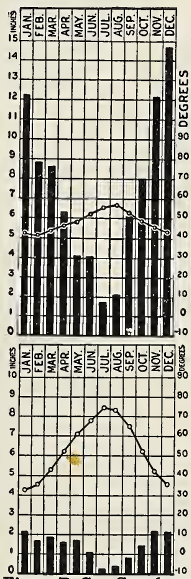
An animal map. On an outline map of the world draw a circle in central Asia north of Tibet to show the homeland of the animals mentioned in this unit; places to which they have spread.

Fig. A. Distribution of rainfall throughout the world from May 1 to October 31. The "wind roses" in the oceans show the directions from which the winds blow during June, July, and August.

UNIT 2—LANDS MADE DRY BY MOUNTAINS

> A Map that Explains. Make a map locating a mountain range, and a diagram that tells something about rainfall and vegetation on two sides of the range.

Zones of vegetation. To understand the title of this chapter find the State of Oregon on Figure 2-A. What does that map tell about central and eastern Oregon? Now look at Oregon on Plate V. You see a mountain range to the west of the Willamette Valley and a higher one to the east of it. Here the winds blow much of the time from the Pacific, and the mountain range facing the sea is so wet that its forests drip with water many days in the year. The trees are so thick that you can scarcely walk among them. In the Willamette Valley, a land of farms, one sees everywhere the green spires of nature, the tops of beautiful evergreen trees.



Figs. B-C. Graph of average monthly temperatures (broken lines) and average rainfall (vertical bars) for two stations in Washington State. Which graph shows rainfall and temperatures along our northwest coast? weather conditions just east of the Willamette Valley?

Now cross the next range to the eastward. Its western foothills are forested; its eastern foothills are treeless. The plains to the eastward are dry and brown in summer, and have only grass and scrubby bushes here and there. No farms are here. This is a land of pastures, flocks, herds, and but few people. What has happened to make this difference?

Mountains and rain. Anyone who has dried clothes knows that warm air dries them more quickly than cold air. This is true because warm air absorbs more water than cold air absorbs. At sea level a cubic foot of air with a temperature of 10° F. will hold but 0.7 grains of water. At 20° F., the air will hold 1.2 grains; at 30° F., 1.9 grains; at 60° F., 5.7 grains; and at 90° F., 14.8 grains.

As the sea wind sweeps over the mountains, it becomes about three degrees cooler for every thousand feet of elevation. Cooling causes the moisture to condense in the form of little particles which we

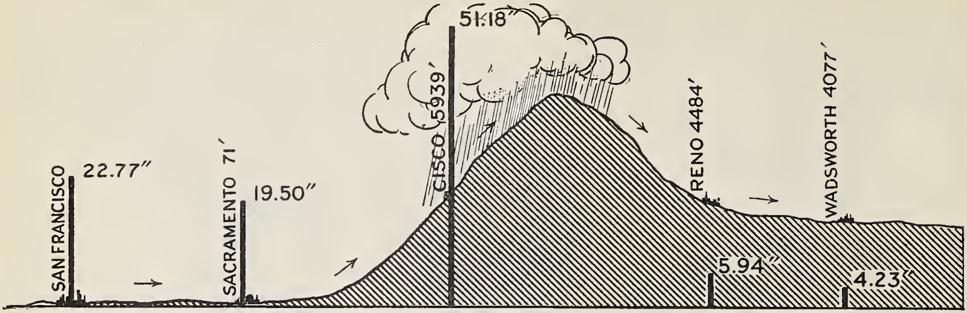


Fig. A. Rainfall on the two sides of the Sierra Nevada. Find in the drawing the elevation of each city; its average annual rainfall. Tell why Cisco has most rain; Wadsworth, least rain.

Fig. B. Drops of water formed by cooling water vapor.

call fog or cloud. As the particles get larger, they become too heavy to float in the air. Then they fall as rain or sleet or snow (Fig. 24-A). What is the average rainfall of western Oregon (Fig. 22-A)? of eastern Oregon? We call the fallen moisture rainfall, or *precipitation,* whether it falls as rain, snow, sleet, or hail.

The rain shadow. The area of land having little rain east of the mountain wind barrier near the Pacific coast of North America is large. It extends from British Columbia through the United States into Mexico. Such a dry area behind a mountain range is sometimes called a *rain shadow.* In addition to the rain-shadow region east of the mountains near the Pacific in North America, there are several others like it in other parts of the world. Examine the physical map of Europe (Plate XII) in the same latitude. What difference do you find in mountain ranges? rainfall? climatic regions (Fig. 2-A)? Explain how European mountains differ from those in western North America.

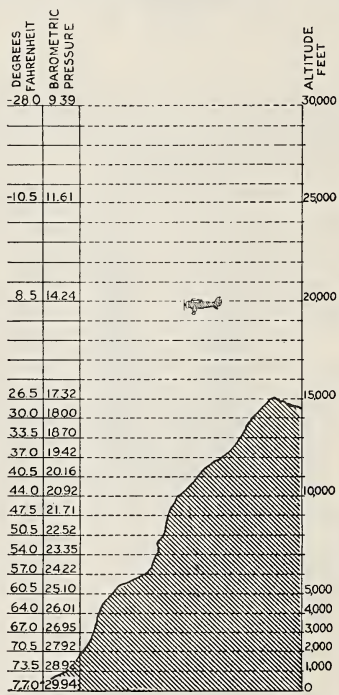


Fig. C. This drawing shows the effects of elevation on temperature and pressure. What is the temperature at sea level in this locality? the pressure? What is the temperature and pressure at 10,000 feet? at 20,000 feet? Approximately how much cooler is the weather and how much less is the pressure of the air with each 1000 feet ascent?

Examine the necessary maps and you can explain for yourself why a rain shadow is found in the southern part of Argentina, in the interior of Asia Minor, in the interior of Syria, of Persia, and in much of central Asia. These are lands of ranches or of pastoral nomads.

THINGS TO DO AND QUESTIONS TO ANSWER

A problem to figure out. If a sea wind has a temperature of 80 degrees at sea level, what will be its temperature on crossing a mountain whose height is eight thousand feet? Look at Figure 24-C and tell how many things it shows that are mentioned or explained in this section.

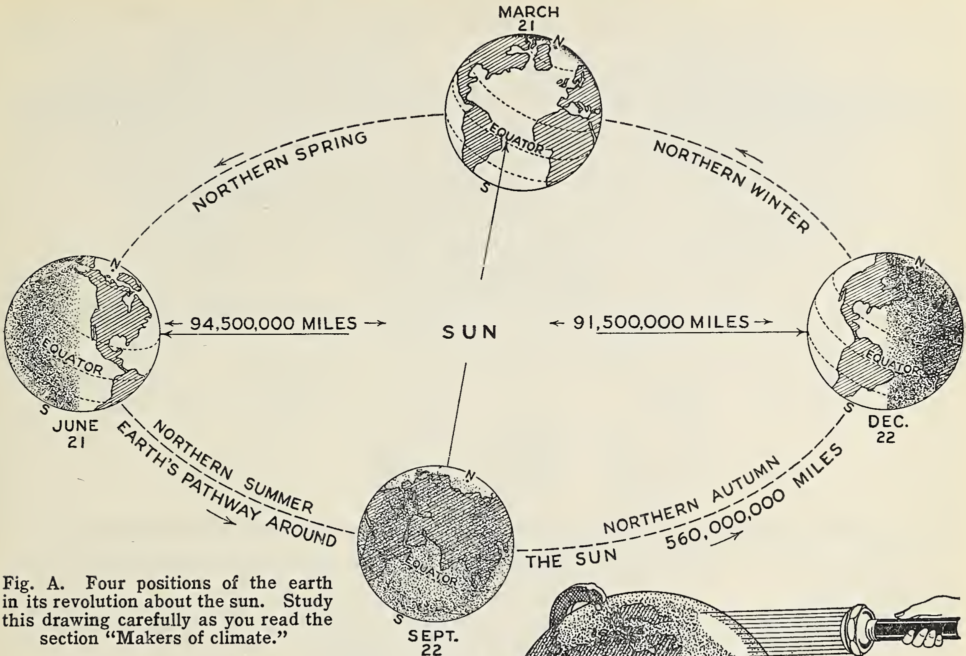


Fig. A. Four positions of the earth in its revolution about the sun. Study this drawing carefully as you read the section "Makers of climate."

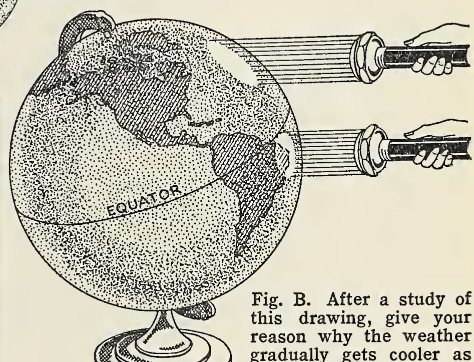


Fig. B. After a study of this drawing, give your reason why the weather gradually gets cooler as one travels from the Equator to the Poles.

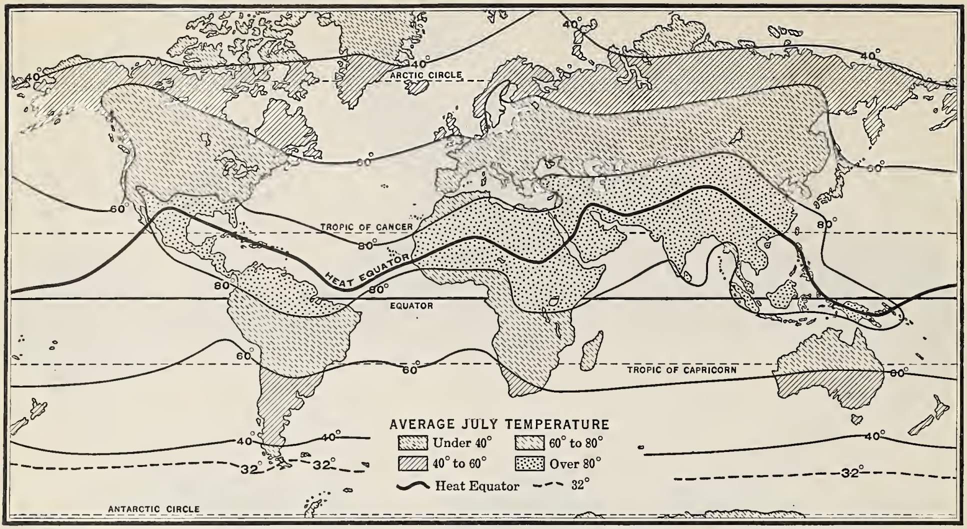
UNIT 3—LANDS MADE WET AND DRY BY THE WORLD WIND SYSTEM

> A PICTURE OF CLIMATE. Draw maps of the part of Africa between the Tropics of Cancer and Capricorn and show by color or shading the vegetation in July and in February.

Makers of climate. Two things about the earth are very important indeed in determining the kind of climate a given place will have. First is the fact that the earth is spherical.

Notice from Figure 25-B that the heat rays from the sun which strike the surface of the earth at an angle fall upon a much larger area than the heat rays which strike directly. Therefore the land near the Poles is colder than the land near the Equator. This unequal heating of different parts of the surface of the earth is one of the basal facts of geography. It explains many, many things that are important to man, to animals, and to plants.

The other important fact is that the earth's axis is inclined 23½ degrees to the plane of its orbit around the sun. Examine Figure 25-A, and see that the sun's rays shine directly on the Tropic of Cancer (23½° north) at one season, and directly on the Tropic of Capricorn at another season. This means that the belt receiving the most heat moves from south to north, and from north to south, each year. Which season are we having in the United States when the sun's rays are vertical at the Tropic of Cancer? at Capricorn? Which seasons are we having when the sun is shining vertically on the Equator?



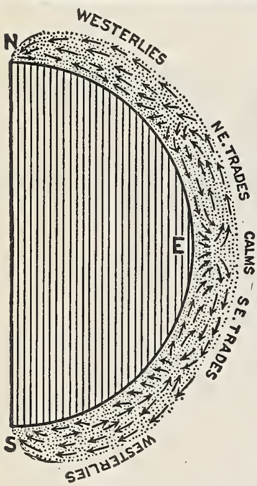
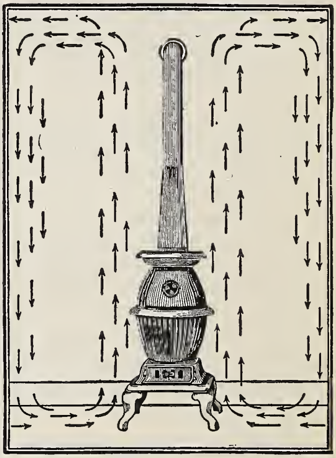


Fig. A. Above is a world chart showing average temperatures for *July*. The wave-like east-west lines are called *isotherms*. On this map the isotherms connect places having the same average temperature for the entire month. Compare the *hot* areas (80° and above) on this map and on Figure 27-A. The *Heat Equator* connects places having the highest temperatures.

Fig. B. At the left is a cross section of one half of the earth and its atmosphere. The atmosphere is much exaggerated in height so that the arrows can show the direction of the air on the earth and above it.

Fig. C. The drawing at the right shows how air circulates about a stove in a room. Try to see for yourself that air circulates this way about burning paper, a heated stove, a lamp, or an outdoor fire.



Air circulation and doldrums. When air is heated, it expands. A cubic foot of warm air weighs less than a cubic foot of cooler air with other conditions the same. In a room where there is a heated stove or a radiator you can see how this expansion of air in heating causes air to move around in a regular system of circulation. In such a room the smoke from a burning match will show the whole story (Fig. 26-C).

The same kind of air circulation takes place on a grand scale upon the earth (Fig. 26-B). Near the Equator air is heated and rises. Since air is rising, there is no wind at the surface. The air is therefore calm. This part of the earth is called the *zone of calms* or *doldrums*. In the days before steamships, sailing vessels sometimes lay in the doldrums without enough wind to blow them a hundred miles in two weeks. A good breeze will take a sailing vessel a hundred miles in a day.

The air in the zone of calms gets cooler as it rises. The moisture in it condenses just as did the moisture in the wind blowing up a mountain side (page 24). Clouds form

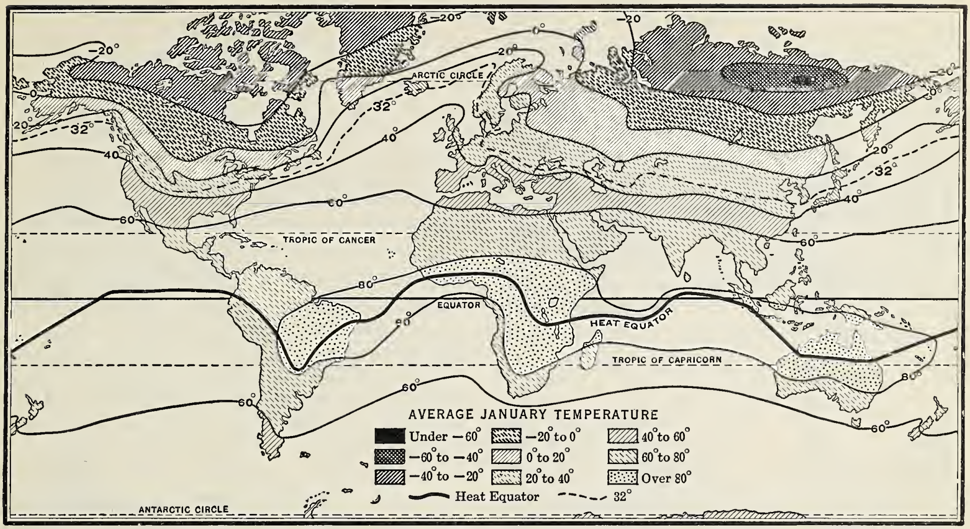


Fig. A. A world chart showing average temperatures for January. What is remarkable about the location of the isotherm of 32°?

and rain falls. In fact, the doldrums have rain almost daily during the rainy season (Fig. 28-D). What is the natural vegetation of such a region (Fig. 2-A)?

Trade winds. The air which rises at the Equator travels northward and southward (Fig. 26-B). Later it comes down at a place which is sometimes called the *horse latitudes.* Most of this air blows back to the Equator in the form of winds that are called *trade winds* (Fig. 26-B). What is the direction of the trade winds at 15° north and 15° south?

Shifting zones of rain and drought. The doldrum season, with its daily rain, travels several degrees of latitude to the north during our summer because the sun's rays fall vertically on land north of the Equator. For the same reason the doldrums and the rains move south of the Equator during our winter. This gives *two rainy seasons* at the Equator and *one* rainy season at places a few degrees north or south of the Equator. When the rainy season is on one side of the Equator, there is a dry season on the other side. The rainy season makes vegetation grow green and rank. The dry season causes the grass to turn brown and many trees shed their leaves as ours do in winter.

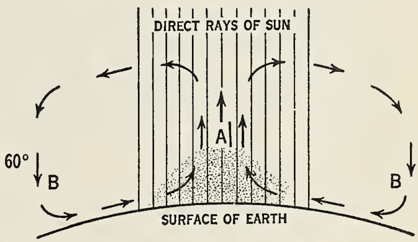


Fig. B. The cause of winds. "A" is an area of high temperature and ascending air currents; "B" is an area of cool temperature and descending air currents.

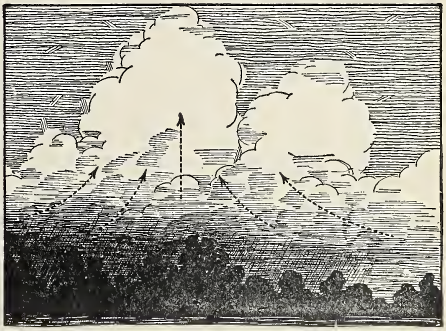


Fig. C. How does this drawing explain rainfall in the doldrums?

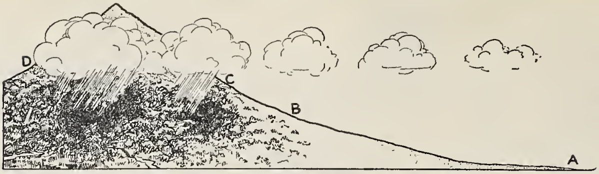


Fig. A. The northeast side of one of the Hawaiian Islands. Tell why the land from A to B is brown and dry; from B to C has patches of vegetation; from C to D is dark green with rich vegetation.

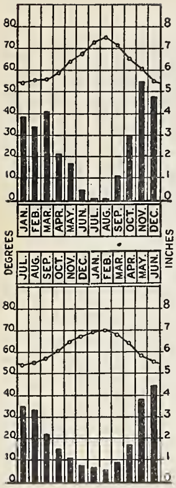


Fig. B. Average monthly temperatures and rainfall at two stations in Africa having a Mediterranean type of climate; Tangier above, and Capetown below. Note the months.

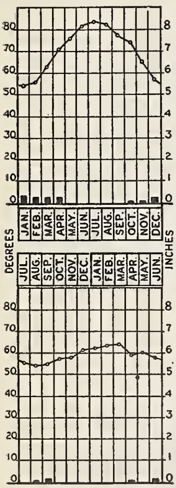


Fig. C. Average monthly temperatures and rainfall at two desert stations in Africa; the Sahara above, the Kalahari Desert below.

Lands with a rainy season and a dry season usually are grasslands, while lands that have rain most of the year usually are forest lands.

Africa shows these climatic zones very well indeed (Fig. 2-A). In the center is doldrum rain and forest. On each side of that enough rain falls to make good grassland. Then to the north and south are regions of less rain and poor grassland. Beyond these, in the horse latitudes, we find so little rain that there are deserts—the Sahara in the north and the Kalahari in the south. Still farther toward the Poles we come to the land of Mediterranean climate, where the summer is dry and the rain falls in the winter.

Zones of pasture land. Now you see that Africa has several zones of natural pasture land: the tropic grasslands on each side of the equatorial forest and the dry lands of the northern edge of the Sahara and the southern edge of the Kalahari.

THINGS TO DO AND QUESTIONS TO ANSWER

An experiment. Perform some experiment that shows how heat makes air circulate.

Explain the quotation. "The belt receiving the most heat moves from south to north, and from north to south, each year." Illustrate your explanation by means of figures. What figures would you use?

A comparison. Compare the circulation of air in a heated room with the circulation of air upon the earth's surface. What figures will you use to illustrate your comparison?

Map exploration. The large trade-wind deserts are the interior of Australia, the Sahara and Kalahari in Africa, the Arabian desert in Arabia, and the desert on the western coast of South America. Find these deserts on a rainfall map and explain to the class why each receives so little rain.

New words to learn. See how many of the following words you can use correctly: circulation, surface, calms, doldrums, zone, and horse latitude.

Find the climate zones. There are four climate zones mentioned in your text: Doldrum rain and forest; good grasslands; poor grasslands; deserts.

Use map (Fig. 2-A) and find these regions in Africa, North America, South America, Australia, and Asia.

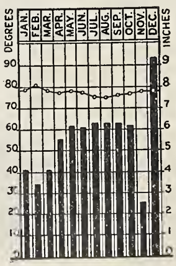


Fig. D. Average monthly temperatures and rainfall at a station in the equatorial rain forests of Africa.

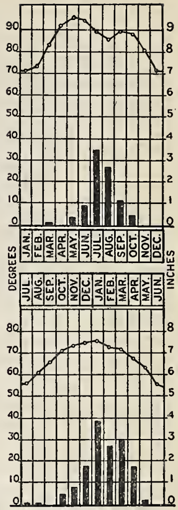


Fig. E. Average monthly temperatures and rainfall at two stations in the poor grasslands of Africa, north of the Equator and south of the Equator.

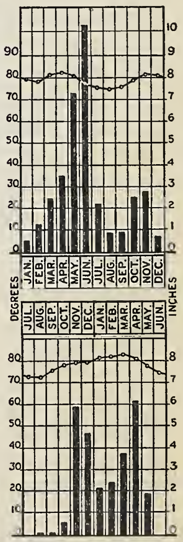


Fig. F. Two stations in the good grasslands of Africa, north of the Equator and south of the Equator.

UNIT 4—PASTORAL INDUSTRIES OF NATURAL GRASSLANDS HAVING LITTLE RAIN

LAND FOR ROVERS. Make a map showing high mountains, snow fields, mountain pastures, mountain forests, a river, irrigated alfalfa land, and a wide pasture plain.

The Great Plains of North America. Let us examine the lands of little rain and lands with a dry season, to see what men do there. We shall begin with the Great Plains of North America. The Great Plains are that large area of grassland with light and uncertain rainfall which lies between the Rocky Mountains and the more humid land of farms to the eastward. How long is it? (Fig. 2-A, Plate III.)

The bison, the antelope, and the Indian. When white men first reached the Great Plains, this large region was the scene of a great annual migration. Each spring and summer millions of bison (buffalo) grazed their way northward from Texas to the plains of western Canada. As winter approached, they returned from western Canada to Texas and Mexico. Fresh buffalo meat, dried buffalo meat, and buffalo skins for tent and clothes enabled the Indians of this region to live a life resembling that of the nomad flock followers of the Old World. Millions of antelopes shared these plains with the buffalo, and also supplied meat and skins for the Indian.

Domestic animals. Soon after the discovery of America by Columbus, the Spaniard brought horses, cattle, sheep, and donkeys to Mexico. Some of the animals escaped. When the first American explorers, hunters, and fur traders crossed the Great Plains about the beginning of the nineteenth century, they found herds of wild horses, called *mustangs*, and of long-horned cattle (Fig. 29-B). Even now there are thousands of wild horses in the Rocky Mountain region and beyond.

The coming of the ranchman. The first railroad to cross the plains was completed in 1869. Then buffalo and the antelope disappeared before the rifle. The cowboy came with cattle and the sheepman with his bands of sheep. Many of the animals spent the summer in the cool pastures of the Rocky Mountains and the winter on the plains. Today all the land of the Great Plains from Canada to Mexico, not used for crops, is pastured. Cattle live on the better pastures, usually in ranges fenced with wire. The cowboy keeps the fence in order. The sheepherder drives his flocks to the poorer pastures because sheep can live on poorer grass than can cattle. Goats can live on still drier pasture. On the Edwards Plateau of west central Texas is one of the three chief centers for the production of Angora goats, whose fleeces

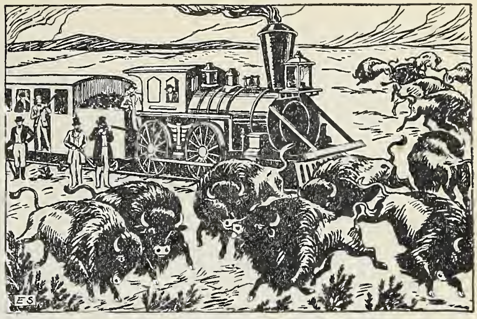


Fig. A. Read the paragraph "The coming of the ranchman," and then tell about the picture.

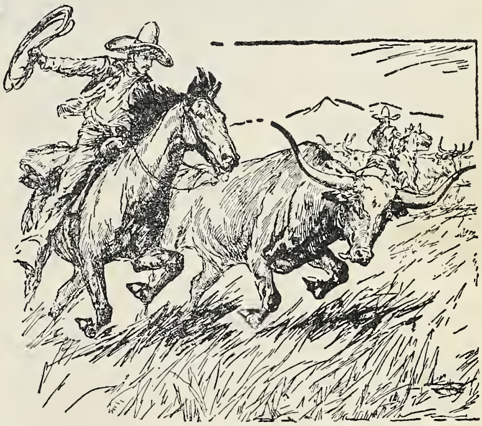


Fig. B. I have seen cattle much like these in Spain, the country from which the ancestors of the old Texas "longhorns" came.

Fig. A. This view of the Edwards Plateau of Texas shows the bushy pasture of dry lands that is to be found in six continents. How many *people* to the square mile do you think it can support?

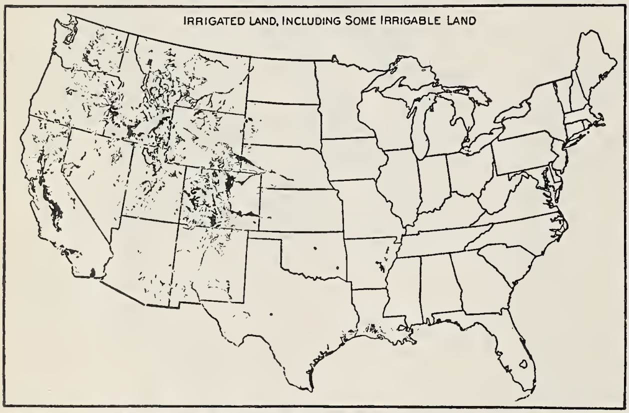


Fig. B. The solid black areas on this map show land which is either irrigated at the present time or can easily be irrigated.

Fig. C. This drawing shows a cross section from east to west through the Black Hills. The cross section shows how underlying rocks pushed and bent upward the level rock layers of the Great Plains, which were afterward worn away by rains and streams. B B is a layer of limestone. In what part of this section is it the surface rock? Water falling on A soaks into the ground and runs under the tight layer (D), and will flow out of wells (C) if their outlet is lower than the surface at A. South Dakota has many artesian wells fed by Black Hills water. Such flowing wells are found in many parts of the world.

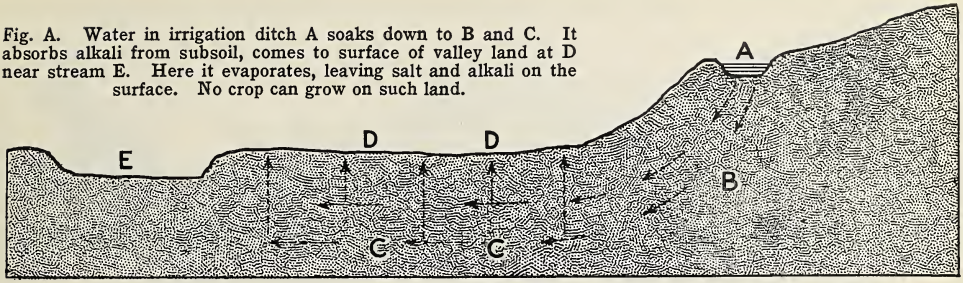
provide valuable mohair. These goats are raised also on similar land in Anatolia and in the Union of South Africa.

Dry public lands in the United States. Much of the land on the Great Plains still belongs to the United States Government because the land is so dry that no one will take it for farming. Because the Government has not yet decided to lease the land, it is used by anyone who wishes to let his animals graze upon it. As a result, the land is badly overgrazed. In many places the grass has been eaten so close that it could not seed itself. In some places weeds have taken the place of grass. In other places no plant remains; and the bare ground, no longer held by roots, is washed into gullies or even blown away. We need a better land policy in the United States.

Winter range and wild hay. On all the great grasslands of the world cattle, horses, and sheep live out of doors winter and summer. In winter horses and cattle have thick coats of oily hair which keep them dry and warm even in cold rains and blizzards. Their great problem is to get enough winter food.

Most of the Great Plains region has some

Fig. A. Water in irrigation ditch A soaks down to B and C. It absorbs alkali from subsoil, comes to surface of valley land at D near stream E. Here it evaporates, leaving salt and alkali on the surface. No crop can grow on such land.



snowfall in winter, but the snow is not deep. If the grass has not been eaten in summer, sheep and cattle can usually dig through the snow and get the dry grass. Sometimes part of the land is not pastured, but its grass is cut and stacked as hay for use in winter.

Irrigation and hay. Hay grown by irrigation in the valleys of the streams is very important in many grasslands. The Great Plains are blessed by the fact that west of them are the Rocky Mountains. Heavy winter snow in the mountains melts through most of the summer months and sends streams of cool water babbling down to the dry and thirsty land. Farmers use the water to irrigate the dry valleys, which then yield many rich harvests. Here we can see the four main methods of irrigation:

(1) A little dam and a small ditch to lead water to a field or two. A man may make it.

(2) A big dam, a big canal many miles in length, watering dozens or even hundreds of farms. The dam and the canal may be owned by a water company or by a water users' association.

(3) Far back in the mountains dams are built in deep, narrow places in the valleys. The valley streams, backing up behind the dams, form artificial lakes or *reservoirs.* In these reservoirs millions of cubic feet of water are stored until wanted on the fields in the valleys miles away.

(4) Artesian wells. Parts of Dakota and other areas of the Great Plains have a certain kind of rock structure (Fig. 30-C) from which water will flow when a deep

Fig. B. 1. the Roosevelt Dam across the Salt River in Arizona has turned dry lands into fruitful fields; 2. arid land before irrigation; 3. irrigated land; 4. abundant crops on land that was a desert.

well is dug. Unfortunately, the water goes into these rocks very slowly. As the wells let it out very rapidly, many artesian wells that flowed freely at first now flow but little.

Good and bad irrigation. Already many acres of irrigated land have been spoiled by alkali (Fig. 31-A).

One advantage of irrigation is that the land does not wash away, because only level or nearly level land can be irrigated. Another advantage is that streams carry small particles of earth, which help to build up the land and fertilize it. The sure water supply helps to make heavy crops.

Alfalfa—king of irrigated crops. Alfalfa is the great crop—by far the most important crop—of the hundreds of irri-

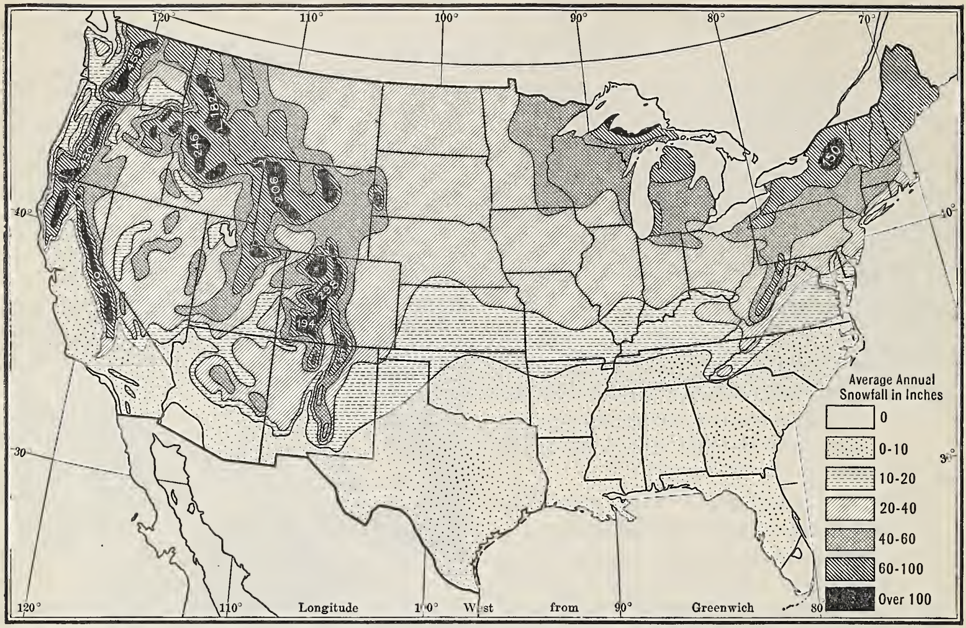


Fig. A. Average depth of snowfall in the United States. Look at Figures 30-B and 31-B and tell to whom the mountains of Colorado are valuable.

gated spots in the Great Plains region. Alfalfa grows quickly. Two crops a year may be cut in Alberta, three in Kansas, four in Texas. It is a splendid winter food for the sheep and cattle that spend the summer on the ranges and the winter by the haystacks.

The modern ranching industry. Since we have made machinery, especially railroads and steamships, farmers from Europe have gone to many fertile lands in central North America, Argentina, South Africa, and Australia where for ages the land had been occupied only by herdsmen and grazing animals.

During the last century an altogether new kind of pastoral industry has grown up in all these continents. A man gets possession of a large tract of land or *ranch*. He has perhaps 10,000 or 20,000 or even more acres of land, often with a barbed-wire fence surrounding it to confine cattle, or a woven wire fence for sheep. A lone horseman repairs the fences, and a lone shepherd with his dogs watches a large flock of sheep.

Tractors, reapers, and other farm machinery have made it possible for one man to grow many acres of wheat. These, and new methods called dry farming, have caused many large sheep and cattle ranches in United States, Argentina, and other countries to be broken up into farms.

THINGS TO DO AND QUESTIONS TO ANSWER

Suggested topics for short talks. The wild horse and cow of the plains; the American buffalo; the life of the sheepman; the cowboy.

Problems for thought. 1. Find why it takes better pasture land to keep cattle than it does to keep sheep.

2. What reasons can you give for the cultivation of alfalfa?

3. What are public lands? commons?

4. What is the rainfall of the place where Figure 30-A was taken?

For those who like to draw. Draw a model illustrating how irrigation might be carried on in the arid regions of the West. Explain to the class how irrigation aids in the production of animals; how Figure 32-A explains irrigation.

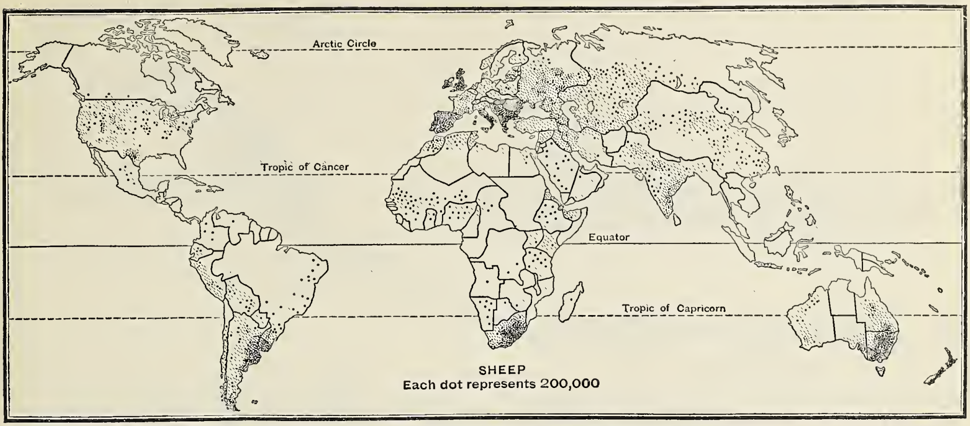


Fig. A. World sheep. Each dot represents 200,000 sheep.

UNIT 5—OTHER LANDS MUCH LIKE THE AMERICAN GREAT PLAINS

A WORLD REGION. Make a sketch map of the world showing all the areas that have a climate much like that of the Great Plains of North America.

Asia and southeastern Europe. On Figure 2-A compare North America and Asia. Trace a line from Hudson Bay through Winnipeg in the direction of San Francisco. Name the first three regions through which the line passes.

Trace a similar line in the Union of Socialist Soviet Republics (Russia), often called U. S. S. R., from the Arctic Sea to the Aral Sea. What regions does it cross?

That belt of Central Asian grassland, so much like our Great Plains, has, for scores of centuries, been the homeland of horsemen riding after their flocks. Here rode Attila the Hun, and Genghis Khan the Mongol. Today its flocks of sheep and cattle serve U. S. S. R. as those of the American Great Plains serve the United States.

Fig. B. 1. a mutton sheep; 2. a wool sheep (Merino); 3. a black-face sheep from the Scotch Highlands; 4. a woolless sheep from Africa; 5. Persian lambs with their mothers; 6. a fat-tailed sheep. (There are many other kinds of sheep.) 7. an Angora goat.

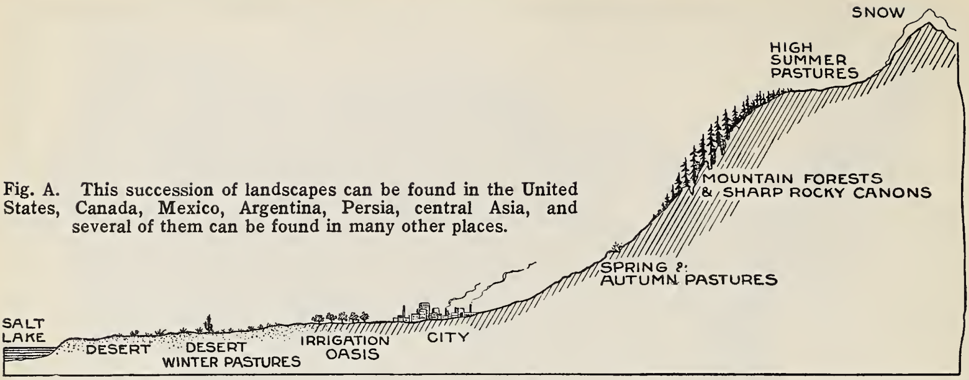


Fig. A. This succession of landscapes can be found in the United States, Canada, Mexico, Argentina, Persia, central Asia, and several of them can be found in many other places.

Unlike our Great Plains, little irrigation is possible in most of the grasslands of Asia because there are few mountain streams that bring water down to the plains that need irrigation.

What do the maps (Figs. 2-A–22-A) tell you about conditions in Asia Minor that help to make it one of the three leading producers of mohair?

Argentina. If you go west from St. Louis to Denver, you pass through a wide area where every farm has corn, another wide area where every farm has wheat, and then a still wider area of ranch land. In Argentina you can find exactly the same succession of belts of land if you travel from Buenos Aires westward.

This South American plain, like that of North America, is long from north to south. It extends from latitude 28° (that of southern Texas) to 55° (that of northern Alberta). On these two ranch regions the traveler would find not only cattle and sheep, but the same *breeds* of cattle and the same *breeds* of sheep. When the prices of wool and meat are low in London and New York, the sheep owners of Texas and Montana talk of hard times, as do the ranchers of Argentina.

There is better grass in southern Argentina than in northwestern Argentina. In the south the grass is nutritious enough to fatten sheep for the market. Consequently there are plants for freezing meat at Magallanes on the Strait of Magellan, and at several points on the Atlantic coast of near-by Patagonia (southern Argentina).

City markets, refrigeration, and canning now cause exports of meat from distant places that once exported only wool, skins, tallow, and bones. Bones are an export of many distant pasture lands.

Australia. Going westward from Sydney in Australia, as from Buenos Aires in South America, we pass through corn lands, wheat lands, and come to grasslands, where a dozen species of the kangaroo once lived, together with big running birds such as the cassowary. The grasslands are now sheep and cattle ranches. They send animals to the ports to be shipped in refrigerator steamers to the markets of Europe.

The great sheep flocks make Australia the chief factor in the world's wool supply. There is scarcely a man in Great Britain, in New York, or in Chicago, who does not wear Australian wool upon his back.

Does South Africa have any climate like that of the Great Plains?

THINGS TO DO AND QUESTIONS TO ANSWER

A comparison. Name two ways in which the South American plain of Argentina is similar to the Great Plains of North America.

A similar area. Part of southwestern Africa has a climate like that of our own Great Plains. Can you find this area on the map of Africa (Plate XVII)? What occupations do you think would be carried on there? Why?

Reports. Report on Genghis Kahn; on Attila, the Hun.

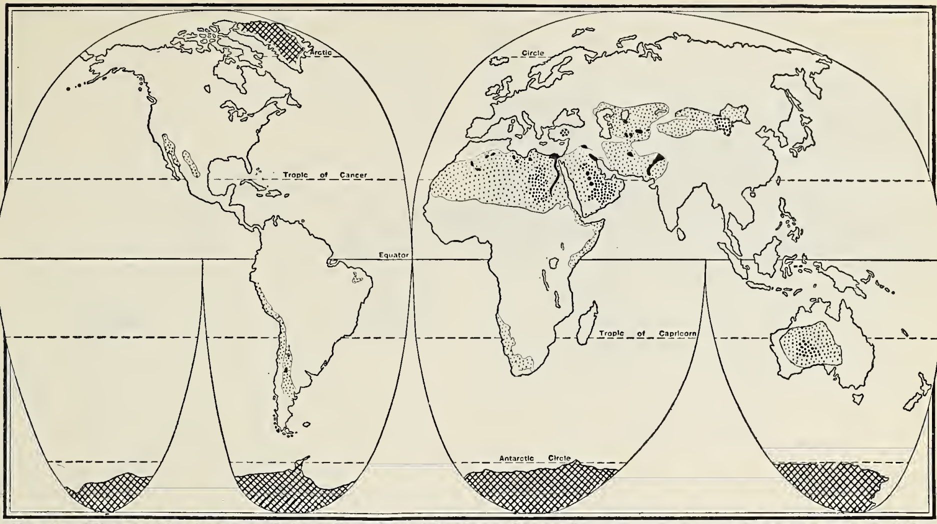


Fig. A. The "cold" desert and the "dry" desert lands of the world. Find these areas also on Figure 2-A.

UNIT 6—THE DRY HEARTS OF CONTINENTS

> THE USES OF A MOUNTAIN. Suppose a mountain 20,000 feet high with gentle slopes should rise up in the center of Nevada, the Sahara, or between the Caspian and Aral seas. Tell what uses this mountain would be to men.

North America. Where is the driest part of North America (Figs. 22-A–23-A)? The United States has 40,000 square miles of land where not even a goat can graze. Surrounding this region in southern California, Lower California, Nevada, Utah, Washington State, Arizona, New Mexico, and the plateaus of Old Mexico is a large area of land which usually supplies scanty pasture for only a part of the year.

Most of this land was once given in large grants by the kings of Spain to their favorites. To this day it remains a land of huge ranches, some covering many square miles. Fortunately there are near-by mountains where sheep and cattle can spend part of the year on high mountain pastures. In such a region an irrigated spot is of great value. For example, on the irrigated lands in the Salt River Valley around Phoenix, Arizona, 60,000 cattle and a quarter of a million sheep are fattened each year. This is made possible by the great irrigation system of the Roosevelt Dam. Many more cattle and sheep are sent out from the arid pastures of this region to other regions to be fattened.

Central Asia, Mongolia, Persia, Iraq, Syria. What do the rainfall map (Fig. 22-A), the population map (Fig. 20-A), and the world-regions map (Fig. 2-A) tell you about these lands? In this vast expanse are found patches of desert, patches of pasture, lands where mountain slopes and high mountain pastures are a blessed relief in summer to man and beast, and where mountain streams make oases of greatest value to man. Every city in that area is an oasis city. Turn to the map of Asia (Plate XVIII) to find the names of these cities.

This dry heart of Asia, like such land in all continents, is unfenced. If it is of any value, it is the pasture land of people who live near it.

Arabia and the Sahara. These lands are much like the others, but with even less rain (Fig. 22-A). In these vast stretches of desert a bit of pasture is found here and there, and here and there is an oasis, per-

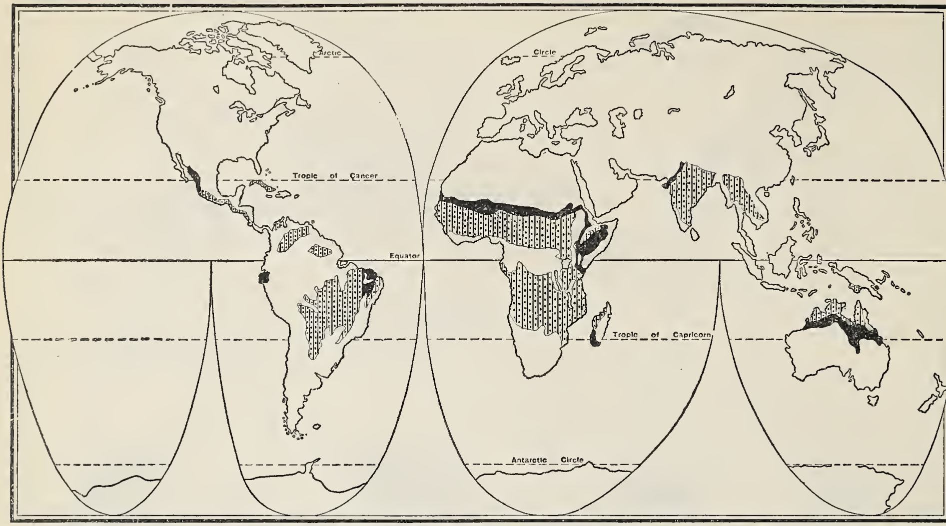


Fig. A. The tropical savannas and grasslands of the world. Find these areas also on Figure 2-A.

haps only an acre, perhaps a square mile, or even ten square miles in extent.

Union of South Africa. How do the maps (Figs. 2-A–22-A) help to explain why wool and mohair are the chief exports derived from the land in South Africa?

Australia. Australia (Fig. 2-A) has in its center large deserts, other large stretches where the kangaroo and a few natives manage to pick a living, and where flocks of sheep come and go. The flocks come in a period when, for several years, the amount of rain has been adequate for grass. When there are several years of drought they go, starving by the million.

THINGS TO DO AND QUESTIONS TO ANSWER

Pointing-out exercise. Go to the map and point out to your classmates four areas that can be called *dry hearts of continents.*

Use your tables. The United States has 40,000 square miles of land that is useless for grazing. Compare this area with the area of the following states: New York, Pennsylvania, Virginia, Ohio, Tennessee, and Massachusetts.

A picture aid. Find a picture of the Roosevelt Dam. Show it to the class and tell how this great dam aids in producing cattle and sheep.

Life histories. Write the autobiography of a sheep in the dry heart of a continent; of a stream.

UNIT 7—TROPICAL GRASSLANDS

LOCATION. Make a sketch map of the world showing all tropic grasslands. Make some kind of mark to show the parts which have the heavier vegetation.

Africa. The great equatorial forest of central Africa is ringed around with grasslands—good grasslands near the forest, poor grasslands farther from the forest. Beyond, at the north and south, are deserts.

This African land of grass is the homeland of antelope, zebra, giraffe, rhinoceros, and also of the lion and the leopard who kill and eat the other animals, and of the hyena and the jackal who pick and crack their bones.

Near the northern edge of the Sahara are nomads who breed camels and horses. But in most of the poorer African grasslands are nomad cattle keepers, not breeders. Cattle stand the hot climate with its damp season better than sheep do. The job of the cattle keepers of the African grasslands is not an easy one. For example, the Fulani, who live north of the Niger, cooperate in groups of four or five to care for a hundred cows. They must build a high thorn fence for a night shelter. One man

herds the cattle, one man takes care of the calves, another must watch all night to keep wild animals away. When the grass near-by is gone, the group and their cattle must move.

Cattle and man's social status. Among some of these African cattle keepers, cattle serve to measure a man's importance as well as his wealth. The more cattle a man has, the higher his rank in society; among the Hereros of southwest Africa, the man who has no cattle is to his neighbors as a tramp is to us in our country.

High esteem for cows. Many of the native cattle keepers love their cattle and mourn them when they die. Some would rather die themselves than kill a cow. They eat their meat only on the rarest occasions, but they drink the milk, use the butter, and sell the hides. Among many tribes every cow has her name; and the shades of color that the native recognizes in describing cows are amazing to the white man. The Kafirs of Rhodesia and the Transvaal decorate the bodies of their cows and make their horns grow in fantastic shapes. In some tribes the modeling of cattle in clay is a great pleasure.

Sheep and goats. In parts of the African grassland are many goats, and sheep without wool. In such a climate a sheep does not need wool. The hair that is under the wool of all sheep is protection enough.

Little foreign trade. This large area of African grassland, with its millions of native people and native cattle, sends little but hides to Europe, although Europeans have of late years established a few modern ranches.

India. At the eastern edge of the Thar Desert (lower Indus Valley) are cattle-keeping nomads whose life is much like that of the people of the tropic grasslands of Africa. Here the people have a saying, "He has five fingers in the butter." ("Born with a silver spoon in his mouth.")

Australia. The tropic section of Australia has cattle ranches owned by white men who employ native laborers.

Fig. A. The tropic savanna, the tree-grass landscape, and a couple of browsers who live in it. Why is the giraffe well fitted for such a country?

South America. The tropic grasslands of South America have a much smaller native population than those of Africa. The cattle industry is usually of the white man's type; it sends some produce to distant markets.

The interior of Brazil sends lean cattle to the coast districts near Rio de Janeiro to be fattened for city markets. São Paulo, Asunción, and other places in southern Brazil and Paraguay have packing plants making canned meat and meat extract. They also have other plants making *tasajo*, a form of dried beef that has long been used in tropic countries because it keeps well.

In the Orinoco Valley is a grassland with a little developed cattle industry.

THINGS TO DO AND QUESTIONS TO ANSWER

Finding the tropical grasslands. Name all the areas of tropical grasslands and locate them on the map.

Finish the paragraph. I have a herd of cattle in Africa. I ———. Read your paragraph to the class. Can they tell you anything that you have omitted about cattle in Africa?

Fill in the blanks. Starting from central Africa you will pass through the following regions if you go

north:	south:
1. Good grasslands	1. ....
2. Poor grasslands	2. ....
3. Desert	3. ....

Fig. A. Find snowfield, bare rock, glacier, and good pasture on this Swiss mountain.

UNIT 8—PASTORAL INDUSTRIES IN LANDS THAT ARE TOO ROUGH, TOO WET, OR HAVE A SEASON TOO SHORT FOR FARMING

Lands of Low Value. Make a sketch map of the world showing by a different mark or color each of the three kinds of pasture land mentioned in this unit.

Western United States. You doubtless know something about the sheep and cattle that spend the summer in the mountain valleys, called *parks*, and in other mountain pastures of western America.

The Andes. In the Andes of Peru and Bolivia the first white explorers found native shepherds caring for herds of llamas and alpacas on pastures from 11,000 to 17,000 feet in altitude. These animals had been domesticated for a long time. The llama carries burdens on his back and the natives today use llama wool very widely in weaving. The smaller alpaca produces long, glossy wool of very fine quality.

Tibet. On the bleak, treeless, and windswept plateaus of Tibet lives the wild yak, an animal that has been tamed for ages. Some yaks stand six feet high at the shoulders and can live on the scanty pastures of the cold, snowy land. These great beasts are among the largest of man's cattle.

The high mountains of Europe. Every mountain region of Europe—Alps, Balkans, Pyrenees, Caucasus, Carpathians, Scandinavian Peninsula—has pastures to which in summer herdsmen bring herds of cows or cattle, or flocks of sheep, from lands of lower altitudes.

Northwest Europe. The highlands of Wales and Scotland are so wet that the farmer cannot plow satisfactorily. But

Fig. A. These sheep are grazing near a sheep station in the far north of New Zealand.

tree growth is kept down by the sheep. The winter winds from the near-by Atlantic are so warm that snow falls but rarely. Sheep live outdoors twelve months in the year, as they do in the Shetlands. They even live out of doors in Iceland, where a few stacks of hay help to protect them from the cold wind.

South Alaska. A land of cool summer and moist winter much like that of Norway or the Shetlands is found on the south shores of Alaska, where, at Kodiak Island, a few cattle have thriven for many years. The United States Government tried the experiment of crossing yaks with Galloway cattle that have lived out of doors on the Scotch highlands. A promising animal has resulted, but it has not yet been widely used.

The Falkland Islands. These islands, so damp, raw, and wind-swept that trees cannot grow, provide a sheep range where Scotch shepherds tend sheep of British breeds.

New Zealand. New Zealand, with a good rainfall and a climate much like that of Great Britain, is a land of splendid pastures, large sheep flocks, and a great export of wool and mutton.

The Arctic tundra. In the fourth century A. D., a Chinese traveler returned from the far North and wrote an account of having visited a nomad people who had vast herds of tame deer (reindeer). This mode of life continues in the tundra, a land of mosses, lichens, grass, herbs, and shrubs. The tundra fringes the Arctic Ocean in three continents. Half a dozen different peoples having a little trade with the far-distant white man are scattered with their reindeer from East Cape by Bering Sea to North Cape and beyond in Norway. You are doubtless familiar with one of these peoples, the Lapps.

American people learn to raise reindeer. In 1891, when the Eskimos and Indians of Alaska were about to starve

Fig. A. Reindeer in northern Sweden. They scratch away the snow with their feet to get at the grass beneath.

because the white men had killed off much of their game, herds of reindeer and their keepers were brought from the Old World to teach the Alaskans the art of raising reindeer. They have learned it. There are now some 600,000 to 700,000 reindeer living in the Alaskan tundra and the scrubby northern and northwestern edge of the Great Northern Forest. Some are used as draft animals instead of dogs. Some reindeer meat is now shipped to the United States.

In 1929 a large herd of reindeer was bought by the Canadian Government, and with the assistance of airplanes to find a route, the reindeer started on a four-year migration to the lower Mackenzie Valley. The government brought Lapps there to teach the Eskimos how to tend reindeer.

The ovibos. Experiments are under way for the domestication of the ovibos, the so-called musk ox, a remarkable animal which yields both good meat and good wool, and, like the reindeer, is able to pick its living in the Arctic tundra. A few herds of ovibos have thus far survived the Eskimo's arrow and the white man's bullet. Like the whale and the seal, the ovibos needs protection so that he may make an almost useless land more useful.

THINGS TO DO AND TO THINK ABOUT

A contest. Choose sides. Let one in the class name an area referred to in this unit. Go to the map and locate it and tell the class what is raised there. Each correct answer scores five points for your side.

Three strange helpers. Prepare a report on either the llama, the reindeer, or the yak.

Answer the questions. 1. Why are mountains used as pastures? Name and point out mountains that are thus used.

2. What climate has southern Alaska?

3. What is the important thing about reindeer in Arctic America?

CHAPTER SUMMARY

Map exercises. 1. List the states which either wholly or in part receive between 10 and 20 inches of rain.

2. What states have areas which receive less than 10 inches of rainfall? Do you think these areas would be good grazing lands? Explain.

3. What relationship does the eastern boundary of the 10- to 20-inch rainfall area have to the 100th meridian?

4. What relationship do you notice between these two lines and the density of population in the United States?

5. Make or trace a map of the world and mark on it the parts where most of the land can be used only for things that grow wild; the places where the animals mentioned in this chapter are raised.

A class scrapbook. Have the class collect pictures of the animals named in this chapter. Select the best pictures and arrange them into a scrapbook.

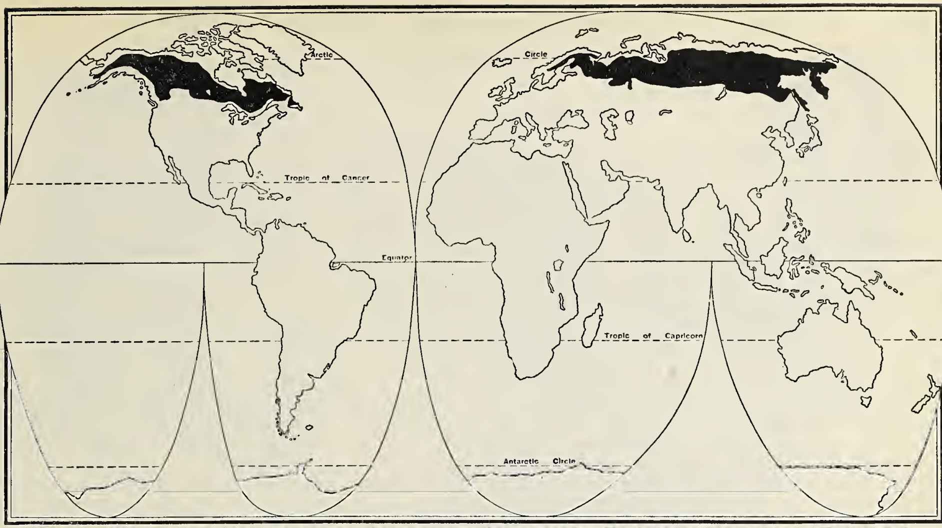


Fig. A. The great northern evergreen-forest areas of the world. Find these areas also on Figure 2-A.

CHAPTER III

FORESTS AND MAN

UNIT 1—WHERE AND OF WHAT USE ARE FORESTS?

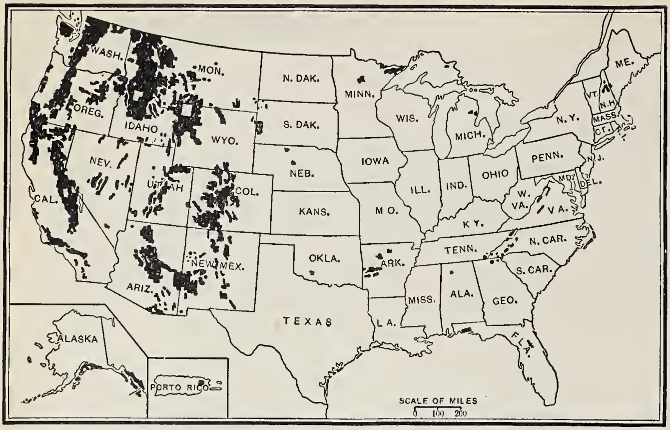
> BUILDING A MOUNTAIN. Make a model or drawing of a very high mountain that stands in a dry land, and put proper zones of vegetation on it.

A natural home for primitive man. Before man tamed animals or grew crops, the forest was one of the best homes that nature provided. In the tropic forest man found a rich supply of wild fruits and nuts for food. In the middle latitude or temperate forests, such as those of France, Germany, Pennsylvania, Ohio, southern California, Chosen, and China, nature had placed nut-bearing trees—hickories, walnuts, beeches, and the oaks with their acorns. These wild crops, which man has eaten for ages, also fed and fattened the bear, the wild hog, the raccoon, and the opossum, and gave man a meat supply and skins with which to cover himself.

In the coniferous forests of high latitudes, in Sweden, north Russia, Siberia, and central Canada, primitive man found a much smaller food supply. But he managed to get some pine nuts (edible seeds from pine cones), a good crop of summer berries, and enough fish and rabbits and other fur-bearing animals to keep a scanty population.

When man became a farmer, the forest near his farm gave him logs for a house, firewood, and material for tools. When he tamed animals and went out on the grasslands, poles for his tent were one of his most precious possessions. Instead of wood for fuel, man used and still uses the dried dung of his animals. This fuel, being the vegetable fibers from grass, is much like wood and is still used today in all deserts and in most of the grassland regions.

The importance of wood. What would happen to your house if all the wood should be withdrawn from it and no more could be had? In Sicily, where wood is scarce and people are poor, I have seen many houses with stone walls and stone floors, supported on stone arches. Stone houses are not only expensive to build, but are death traps in earthquakes. Make a list of all the uses to which wood is put



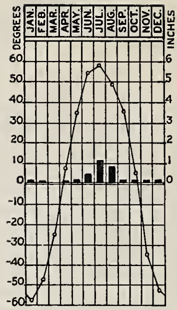


Fig. B. Average monthly temperatures at the coldest place in the world: Verkhoyansk, in the great northern forests of Siberia.

Fig. A. These national forests belong to all the people in our country. Many small cities in Europe own forests and their people pay no taxes because the income from the forests supports schools and city government. Get the report of Chief Forester, United States Department of Agriculture, Washington, D. C., and find out how our national forests are managed. Compare the temperature of Verkhoyansk with places in Norway (Fig. 27-A).

near your schoolhouse. What would happen if the wood were not to be had?

Trees and heat. Trees must have heat above 50° F. some weeks during the year.

When we consider forests and temperatures, we see some strange things. Iceland has no forest; but compare its winter temperature with that of New York City (Fig. 27-A). Yet there is a coniferous forest at Verhoyansk in Siberia (Fig. 42-B). What is the winter temperature there? It seems that the extreme cold of winter does not kill the trees, and the sunshiny summer allows them a few weeks for growth. This forest grows because the summer of the *continental climate* in the interior of the continent is so much warmer than that of Iceland with its *oceanic climate* (Fig. 27-A).

Trees and moisture. The amount of rain necessary to support a forest becomes less as one goes north, because of decreasing heat and less evaporation. Trees are almost absent from the wide areas of tropic grasslands (Fig. 2-A) which have a heavy rainfall during one season (Fig. 28-E) and then months of dry heat. Although trees need moisture through the year, few species can grow in water-soaked ground. But fortunately the cypress of our southern states lives in swamps.

Forests on mountains. In a dry country, such as Colorado or Persia, the lower plains are without forest. As we begin to ascend the mountains, we find more rain, lower temperature, and small scattered trees. Farther up we come to a zone of larger trees. Still higher, where it is colder, the trees thin out, and finally become little wind-twisted bushes. Beyond them we again find grass and shrubs. The plants here are much like those of the tundra. Forests on mountains have within a few miles the same *zones of plants* as are found in the long journey from the grasslands of Colorado (or Africa) to the grasslands of the tundra in northern Canada or northern Eurasia. The upper tree line is about 12,000 feet on the Andes at the Equator, 2000 feet on the south coast of Alaska, and at sea level in central Alaska.

THINGS TO DO AND QUESTIONS TO ANSWER

Things to think about. 1. Primitive man in forests. (*a*) What did he eat? wear? (*b*) Where did he sleep?

2. Name any four countries, or places, that are found in temperate forests. Locate on a map.

3. Name ten important uses for wood.

4. Get a sample of as many different kinds of wood as you can. Label each kind. What use can be made of each?

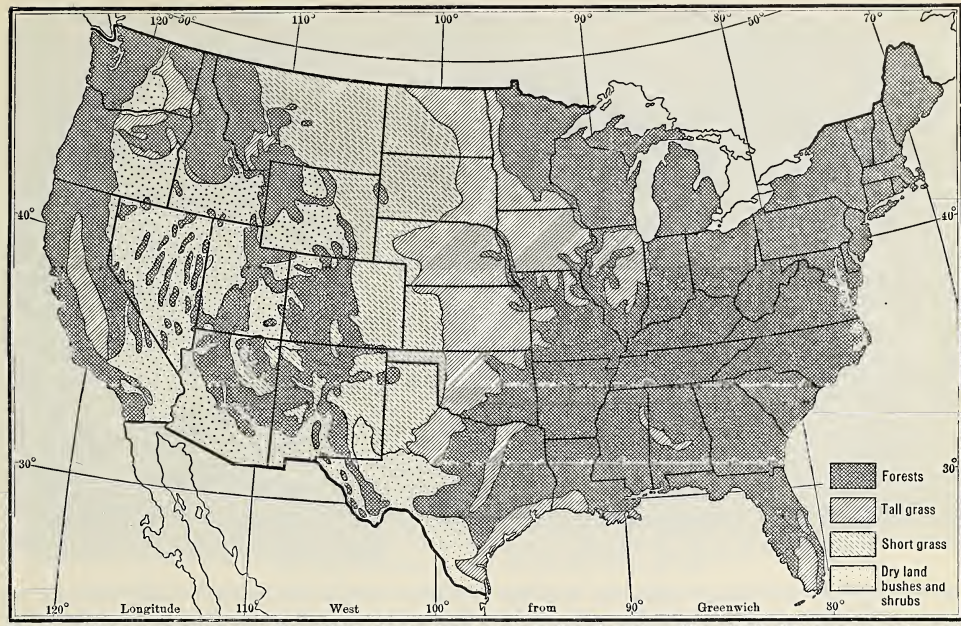


Fig. A. Natural vegetation. Two fifths of our area was once fine forests. Now half of it is gone and much of that which remains is second growth and badly burned. See Figure 50-B. How *was* your state?

UNIT 2—THE FORESTS OF EAST CENTRAL UNITED STATES, AND SIMILAR FORESTS IN EUROPE AND EAST ASIA

> AN EXPLANATION. Tell how and why people in different countries treat their forests so differently.

Forests rich in timber. Europeans who settled the United States found there a very rich forest region containing many more species of useful wood than grew in Europe. Almost continuous forest covered most of the eastern section of the United States (Fig. 43-A). In Illinois, stretches of fine grassland began to appear, with forests only along the streams.

Between the Mohawk Valley and the cotton belt the forest at low elevations was chiefly of oaks, hickories, walnuts, chestnuts, and tulip trees, with some pines on the sandy part of the coastal plain from North Carolina to New Jersey. The cooler climate of the higher Appalachians suited the northern trees such as hemlocks, pines, and spruces. These three great trees of New England are found along the higher Appalachians, from the Catskill Mountains near the Mohawk to western North Carolina.

Clearing and lumbering. During the period between the settlements at Plymouth and Jamestown and the Revolutionary War, the Americans were chopping down their lowland forests to make way for fields. Late in the eighteenth century, they began to cut timber on the Appalachian Plateau and mountains. In winter, the farmers went back into the mountains, cut logs, and hauled them to some river bank. When the spring rains and melting snows produced the spring freshets in the river, rafts of logs or lumber were floated down to Philadelphia, Baltimore, and Pittsburgh. In 1805, the first lumber from western Pennsylvania reached New Orleans.

In the early years of the nineteenth century it is reported that one could walk in

Fig. A. A portable sawmill in the Appalachian forests of northern Georgia. Find in the picture the circular saw, the log to be sawed, the engine, and good saw logs.

the springtime for thirty miles on the log rafts that lay in the Canisteo River, a branch of the Susquehanna, in southern New York. This great collection of timber was the harvest of winter's work of the farmers for many miles around. Some of the rafts were logs; some were lumber. Much labor was required to blast rocks from the rivers and to make passageways for the floating log rafts. The dangerous trip downstream was a great adventure for the young men of the frontier counties of southern New York. For more than sixty years the rafts went on many rivers. When we had built a network of canals, the rafts on the Susquehanna stopped at Port Deposit, near the head of Chesapeake Bay. The lumber went on boats through canals to Philadelphia and New York.

The railroads come. When railroads had been built in many directions through Appalachia, the work of lumbermen was no longer limited to land a few miles from a large stream. Portable sawmills (Fig. 44-A) could be moved easily. When the lumberman had cut one tract, he could buy another cheaply and move his mill to it.

The portable mill and fire. Land and lumber were so cheap that it did not pay to keep the fire out of the woods. Indeed, one owner could not have done so if he had tried. The land was mostly in small tracts, and fire can be controlled only by a planned campaign and with the coöperation of many men. Devastated by repeated forest fires, Pennsylvania, once so rich in forest, now produces only a tenth as much forest products as she once did, and only a quarter of the amount she uses. It is now so easy to haul lumber by train that Pennsylvania sends to other states most of the lumber she produces, and actually brings in twenty-four twenty-fifths of the lumber that she uses. This is chiefly because wood of different qualities meets different needs.

State forests. Many a tract of timber land in Pennsylvania and other states once had many trees with trunks two feet in diameter and 80 to 100 feet high. Today these areas, having been lumbered once or twice and burned over many times, have no vegetation higher than your waist. Many an owner refused to pay taxes. The land then became state property. Therefore we now have state forests in Pennsylvania and in many other states. Most of the state

Figs. A-B. Above is a temporary logging railroad on the Atlantic Coast Plain in North Carolina. Tell about getting out this timber and that in Figure 56-B. ¶ At the left is a stand of long-leaf pine, eight years old, in Louisiana. Find the leaves, or *needles*, as they are called. Are these trees wild or were they planted by man? Is this forestry? See Figures 50-B and C.

forests have little timber, but there is some hope of production for a distant future if the fires can be controlled.

The hardwoods. All coniferous trees with long, narrow leaves like needles (Fig. 45-A), such as pine, spruce, and hemlock, are called *softwoods*. The foliage of softwoods is green all the year. All broad-leaved trees, such as oak, maple, hickory, and walnut, are called *hardwoods*. These trees are leafless in winter. The greater part of the world's lumber comes from softwoods. Most of the beautiful woods used for furniture and house finish are hardwoods. After most of the pine on the Appalachian Mountains had been cut, the lumbermen began to cut the oak of West Virginia, Virginia, the Carolinas, Kentucky, Tennessee, and the Ozarks. In scattered places, oak timber is now being cut by many small portable sawmills and sent to all parts of the United States where oak lumber is in demand; for instance, to Michigan, Ohio, and Indiana, where the supply of oak is greatly diminished.

Forest areas of western Europe. The part of Europe lying west of Russia and Poland, north of the Mediterranean, and south of the Baltic, originally had forests much like those of east central United States, but with fewer varieties of good timber. England, France, Germany—all the lowlands, indeed, except the treeless plains of Hungary (compare treeless portions of Illinois)—were once dense forests, chiefly of oak and beech, with pines on the sandy parts of the plains and spruces on the mountains.

Forestry. Long ago, man cut most of these lowland forests to make room for homes and farms in the plowable land. Man has been in Europe a long time, and he discovered centuries ago that he was very uncomfortable if he did not have wood. So the people of most western European countries began planting forests and taking care of them a hundred years ago, in some parts 300 years ago. More than one fourth of Germany is in forest.

As you ride through the United States in the autumn or the spring, you may see forest fires and ruined forests. In Europe, forest fires seldom occur. The reason is partly climatic: there is not so much drought. But the absence of forest fires in Europe is due mostly to watchful care.

Fig. A. Southern Germany—well-kept fields; well-kept forests. See Figure 50-B.

There the people rush to a forest fire and help to put it out at once. This is more easily done in Europe than in America because the population is more dense and more people are available for fighting fire. Also in western Europe there are no large areas like the wide reaches of the Appalachian Plateau where the population is very sparse and the fire has a good chance to get a start.

European timber as a crop. When Europeans cut timber, they usually replace the trees by planting little trees near by. In Sweden those who cut trees *must* plant more trees. In America cut trees are rarely replaced. On almost any European mountain side where you see a strip of land strewn with logs and brush piles, you will see, beside it, a strip where little trees are growing; in another strip are trees thirty to forty feet high; and in another, larger trees. In Germany, Austria, Switzerland, and other countries trees are systematically thinned out at certain stages of their growth. Little trees are cut for palings, larger ones for poles, still larger ones for small saw logs, and finally, the giant trees that remain are cut for big saw logs. In some places coppice, the shoots that grow up around stumps, is cut at intervals, perhaps every seven years, to be used for vine props and brush fuel. See Figure 47-A.

Sand and pines. The section of southern France near the Bay of Biscay was once moving sand dunes. Men stuck brush in the sand to keep it from blowing about. Little pine trees were then planted. Now the dunes are a pine forest where trees of a certain small size are bled to death to get turpentine. The trees are then cut and used as poles or props in British coal mines. Larger trees remain to become saw logs. Study carefully Figures 46-A and 47-A.

European oak. Yugoslavia, much like southern Appalachia, is an exporter of oak timber. Another important crop of the Balkan forests is pork from pigs that fatten on the acorns and beechnuts they pick up in the forest. Yugoslavia exports hogs to the city markets of her more populous neighboring countries.

An almost forestless country. The United Kingdom has but little forest—4 per cent of the area. The trees were cut down long ago, and the United Kingdom depends upon exporting manufactures and buying wood.

The Mediterranean countries are also short of good timber, because of the dry summer (Fig. 28-A) and because the dense population needs land for crops or to use for pasture.

China, Chosen (Korea), and Japan.

China north of the Yangtze Valley, and Chosen, and Japan, have a climate much like that of east central United States. As I traveled through Chosen in October, the varieties of trees and their appearance made me feel that I might be in northern Virginia or southeastern Pennsylvania.

The population of China is so dense and the people have been there so long, that most of the forests have long since gone into the stove and saw yard (Fig. 57-A). China is a country that suffers from scarcity of wood and lumber. The little fuel the people have is chiefly cornstalks, beanstalks, grass, leaves, and straw. In some places they have cut down the forests from the hills and dug up the roots for fuel. Gullies have washed the good soil away, and what was once a forest, then a farm, is now a useless waste. China imports lumber, but she cannot buy much because she has so little produce to sell.

The hill forests of Chosen and Japan have often helped to feed rice fields. For a long time these peoples have cut out from the woods each year shrubs and all kinds of small plants. These they piled up to rot and make fertilizer for the rice fields in the lowlands. In some parts of Chosen this has gone on for so long that the soils are exhausted and can no longer produce vegetation enough to protect the surface from erosion. Frightful gullies are destroying the hill lands.

In Japan, the strong central government is giving large areas of forest as perfect care as the Europeans are giving to their forests. But with her large population Japan cannot supply all the lumber she needs, so she imports heavily from the United States, Asiatic Russia, and Canada.

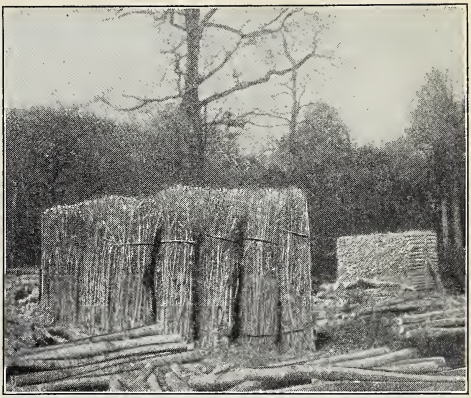


Fig. A. Fagots, firewood, and poles in a French forest. Some forests in France and Germany are planted with trees about four feet apart. The *first* cutting makes small poles for fence palings (Fig. 50-C).

THINGS TO DO AND QUESTIONS TO ANSWER

Saving the forests. 1. What is your state doing to aid the timber supply?

2. Tell about forest fires in two continents.

3. What is forestry? Find some pictures in this chapter that show something about it; some that show the need of it.

4. What would happen if all the wood about your home were removed?

Tree resources. 1. What trees did the settlers of the region south of the Mohawk River find at low altitudes? high altitudes? In which sections of the country were these found (Fig. 43-A)? Fill in an outline map showing these regions. What early uses were made of lumber in America?

2. America was found to have (more—same—fewer) species of useful wood than Europe.

3. What Far Eastern countries have much timber? little timber? Why?

4. On an outline map indicate the chief forested areas of Europe.

5. Distinguish between deciduous and coniferous trees; between hardwoods and softwoods. Where are they found?

(*a*) The spruce is a ——— type of tree.

(*b*) The oak is a ——— type of tree.

Lumbering. 1. Describe the experiences of men in getting timber in the Appalachian region at different times. Did it differ? Why?

2. Europe has (more—same—fewer) forest fires than the United States. Why?

Trees and climate. 1. What is the difference between altitude and latitude? Which of these would offer the quicker way to study the different kinds of trees? Why?

2. Where is the coldest place in the world? Are trees found there? Explain.

3. In Sicily the wood is ——— and the people are ———, so they make their homes of ———.

4. What kind of tree can grow in swampy places? How?

Debate. Resolved: That it would be better to live as primitive man did than to live in a big city.

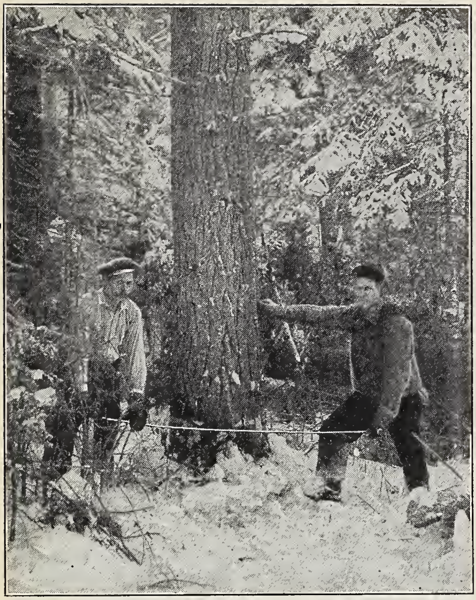


Fig. A. Point out on Figure 2-A all places where such a scene as this from Minnesota might be found.

UNIT 3—FORESTS OF NORTHEASTERN UNITED STATES, EASTERN CANADA, THE LAKE REGION, AND THE GREAT NORTHERN FOREST OF CANADA AND ALASKA

> Something to Work Out. Make a model of a northern softwood forest in summer and in winter.

The forests of the Adirondacks, the highlands of New England, and neighboring Canada. This upland region does not invite the farmers very cordially to come clear the forests and to make fields and homes for themselves. . Much of this land is so high and cold that spring frosts continue into May and June. Autumn frosts begin in August or early September. This gives the farmer only a very short growing season.

All of this land was once covered by a great ice cap, the *continental glacier*. The glacier scraped over it, tore it up, piled it in rugged hills, disturbed the streams and made many swamps, lakes, and waterfalls, and littered much of the land with stones. Most of the surface is too rough for farms. But the climate makes it a place where pine, spruce, and hemlock are at home, while maple, beech, and birch trees are scattered here and there in this great region of evergreen forests and snowy winters.

Logging on rough land. How can man get the lumber from such land? He cannot build railroads, because they would be too expensive when they are to be used only for lumbering. The land is so rough, so stony, so swampy, that wagons cannot be used. But winter brings to the lumberman the blessing of deep snow. Week after week snow falls and packs. It finally becomes two or three feet deep and solid enough to bear the weight of horses or tractors. These drag sleds loaded with logs over the surface of the snow, while buried underneath are stones and fallen logs which would make hauling by wagon impossible in summer.

The two-job man. For more than a hundred years in northeastern United States, many farmers had another job besides farming. Farmers from the more fertile parts of New England went, at the beginning of winter, to lumber camps, where they lived in log cabins in the woods. They took horses, sleds, and food, and spent the winter chopping, hauling, and piling logs by the stream bank.

The log drive. With the spring freshet came the great adventure of the year. With sharp, pointed poles, and spikes on their shoes, the river men risked their legs and their lives every hour of the day, as, pushing, prizing, and pulling, they steered the logs past rocks, over rapids, trying to keep them from becoming log jams which would choke the streams and stop transport. Breaking a log jam is an exceedingly dangerous job, and when the logs do start —run, run for your life! Sometimes you must run to safety across a mass of floating logs that squirm almost as do snakes.

All through the colonial period and for more than half of the nineteenth century

New England was the important lumber exporter for the United States. But the forests were too closely cut. They passed the peak of production many years ago, and now many farms—even whole neighborhoods—are abandoned partly because there is no longer winter work in the near-by woods.

Wood pulp and paper. In recent years new uses for wood have been found. By cutting wood into chips, grinding it, treating it with chemicals and running it through huge machines (Fig. 299-A), we turn its fibers into paper. We can now take mill waste, chips of wood, even sawdust, and make their fiber into paper board which we all know in the form of cartons. The northeastern lumber region is shifting its basis from making lumber to making paper. Lumber requires the big logs that become scarcer every year, but small trees and small pieces of wood are as good as any for the manufacture of paper. Much of the wood that now comes down the New England streams is four-foot sticks of pulp wood. Maine now imports wood from Canada to help supply her paper mills. The United States imports large quantities of pulp and paper from Sweden. Whenever you pick up a book or a newspaper, you reach into a distant forest.

The paper mill and forestry. The sawmill is often a small affair. It can be put upon wheels and hauled away when the timber has been cut. The paper mill is more permanent. It must have a great water-power plant to make power to grind the hard logs into fiber. It must have huge tanks and long, heavy machines for manufacturing pulp into paper. The owners of a paper mill cannot move their plant to a new forest, nor can they afford to leave so costly a plant. There is nothing to do but to take care of the forest that supplies wood for the mill. The best forestry among American private forest owners is that of the paper companies. They plant trees and work to keep out fires. By plant breeding, one paper company has recently made new hybrid varieties of trees that grow much faster than any that nature has produced (Fig. 53-A).

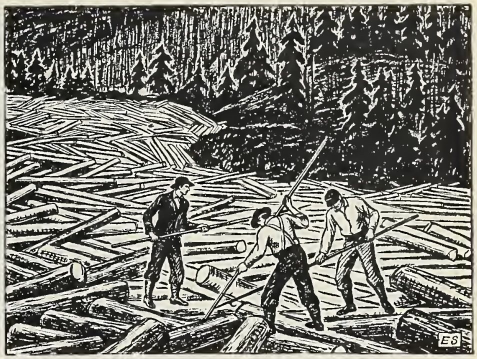


Fig. A. A log jam on a Michigan river. Tell the story that one of these men might tell; that the land owner might tell; that the forest might tell.

The forests of the Lake region. The northern part of the lower peninsula of Michigan, northeastern Wisconsin, eastern Minnesota, parts of Canada adjacent to Lakes Huron and Superior are in every respect much like the upland of New England and eastern Canada—marked by ancient glaciers. They are now lands of rocks, lakes, swamps, snow, and forests. Both regions have the same species of trees. Both have a small lumber industry; much cut-over land; abandoned lumber camps; areas of once splendid forest now burned over and reduced to wastes capable of producing nothing of value. The three Lake states, Michigan, Wisconsin, and Minnesota, produced more than four times as much lumber in 1889 as in 1928. In the latter year, which was a year of good business, Michigan, which once was the leading lumber state in the Union, produced only one fourth as much lumber as she used. Here, as in New England, paper mills are replacing sawmills.

The Great Northern Forest of Canada and interior Alaska. On the map (Fig. 2-A) find the bounds and length of the forest region beginning north of the St. Lawrence Valley. How wide is this area from north to south?

Fig. A. After lumbering in an American forest. Why are there no little trees left? What would the Swedes or Swiss or Japanese think of this?

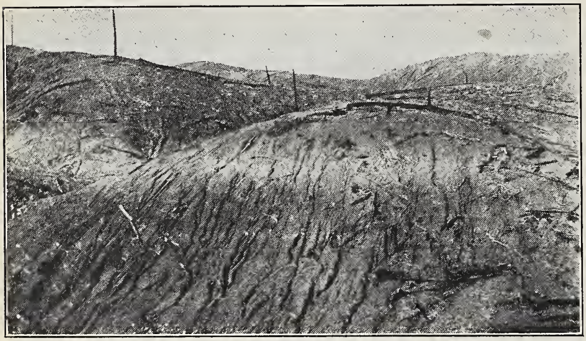


Fig. B. These foothills were once covered with a fine forest, then came the lumberman; then Figure A; then fire, another fire, yet more fires; and now? Many of our states have such scenes as this.

Fig. C. A hillside after a fire and followed by many years of protection.

There are a few railroads in the southeastern corner of this vast region. Two main continental lines cross Canada. But most of its surface is a land without transport that can handle lumber. There is one exception to this—the part that is drained by the St. Lawrence River. Here railroads and log drives have carried logs to Ottawa and made it an important lumber-manufacturing center. The streams coming down to the St. Lawrence from the Laurentian Plateau produce much excellent water power. They also float pulp wood down to a series of mills along the shores of the St. Lawrence River and Gulf at points where steamers can load pulp or pulp wood and sail to the open sea.

Most of this Great Northern Forest is of no use to man, except for furs and minerals. The vast resources of timber are unused except for a few log cabins and widely separated trading posts. A little lumber is cut near the wheat region. Think what this region would be if all of its rivers flowed southward!

The future of this forest. The Great Northern Forest is one of the forest reserves for the future. Unfortunately, much of it is burned and burned again long before commerce can use it. In the uninhabited parts of the Great Northern Forest a fire often sweeps on and on, until streams or a change in the direction of the wind stop its terrible progress. Protecting this forest is a difficult task, but the airplane may help.

Things to do and think about. 1. Tell about snow and the lumber industry, freshets and the lumber industry, different kinds of mills and their influence on forestry.

2. What is meant by a "two-job man"? Does he have any relation to an abandoned farm?

3. Why can Canada furnish so much wood pulp?

Some things to explain. 1. Make a short talk about (*a*) "Our leading lumber state"; (*b*) "The glacier and the paper mill"; (*c*) "The influence of cartons on forestry; on handling timber"; (*d*) "Life in the Great Northern Forest."

UNIT 4—FOREST REGIONS OF EUROPE AND ASIA RESEMBLING THE NORTH AMERICAN FORESTS STUDIED IN PRECEDING UNIT

> INCREASED TRADE? Suppose the Arctic Ocean were navigable for 90 days each year. Who might be affected and in what manner?

Forested countries like northern New England and southeastern Canada. What countries touch the Baltic Sea east and north of Germany? When North America was partly covered by the great glacier, a glacier in Europe covered Norway, Sweden, and the Baltic countries. The glaciers there did what glaciers did in New England. They left a land of rocks, swamps, lakes, and streams, with many waterfalls, and therefore potential water power.

As in New England and eastern Canada, these countries of northern Europe have a short growing season. Therefore both surface and climate make it necessary that man must use most of Norway, Sweden, and Finland as forest if he uses it at all. In Poland, Latvia, and Lithuania forest products are also important exports. In all of these countries many farmers become wood choppers in winter.

Forestry. Sweden is the leader in forestry. Switzerland, Germany, and France rival her in giving their forests the most perfect care. Sweden knows that if her forests go, her industries must go and her people must go. Therefore Sweden sees to it that as trees are cut, others are planted, and that forest fires are put out. The many short rivers that flow down from the mountains have been carefully cleared of stones so that logs may be floated. Near the mouths of the rivers are small towns and villages where the industrious Scandinavians are busy making articles of wood. Lumber, pulp, and paper are important exports. Sweden is second only to the United States as a manufacturer of wood pulp. Much of Sweden's supply comes to the United States.

The spring rush of ships. The northern part of the Baltic is frozen in winter. But when the ice breaks up in spring, steamers rush in from half a dozen countries of West Europe to get cargoes of mine props, lumber, pulp, and paper.

Russia. How long is the forest that has its western end at the Gulf of Bothnia (Fig. 2-A)? How wide is it at its wider parts? In Russia the western part of this forest has streams that carry logs northward to the White Sea, which is open for ships in summer. Thus Arkhangelsk is one of the world's important lumber ports.

On the south side of this forest is the great Volga River. In spring, when the ice breaks, the lumber of northern Russia floats down from the forested upper branches of the Volga to the treeless farm and pasture lands of its lower course.

Siberia. The southern edge of the Great Northern Forest in Siberia furnishes lumber for Russian farmers in the wheat plains, as do the similar forests to the farmers of similar wheat plains in Canada.

As in North America, most of the Great Northern Forest of Europe and Asia is out of the reach of the lumber merchant. Its streams flow northward to the Arctic Sea, a sea so full of ice that ships cannot go there to get lumber. The annual freshets cast driftwood upon the Arctic shores. The wood is used for fuel, house logs, and sled timber by the few fishermen or reindeer men found in that almost uninhabited land.

Forests of the North Pacific slopes of Asia. The Amur and other Siberian streams flowing to the Pacific give possibility of floating wood to the sea. The Russians already have a lumber industry there and, if cared for, this end of the Great Northern Forest can send much produce to market.

SOME THINKING AND SEARCHING

Some explanations. 1. Tell about:
(*a*) streams and timber in Europe and Asia;
(*b*) forestry in Sweden;
(*c*) the spring rush of boats to the Baltic;
(*d*) The life-story of an American newspaper.

UNIT 5—THE LOWLAND FORESTS OF OUR SOUTHERN STATES AND OTHER FORESTS IN SIMILAR CLIMATES

A TIMBER MAP. Mark on a sketch map or outline map all of the lumber regions mentioned in this unit.

A forest without duplicate. South of the Appalachians and the Ozarks, a noble and almost unbroken forest once reached from Norfolk to Florida and central Texas. On the sandy parts were pine, much of which was the hard variety called *long leaf* or *Carolina pine.* This wood, good for flooring, is used in most parts of the United States and in many foreign countries.

Oak and gum grow on the richer alluvial lands near the streams. Gumwood is sliced into thin layers, called *veneer*, and is used for berry and fruit boxes. It is also glued together in layers to make the so-called *plywood*, which is very strong and is now finding many new uses. Much furniture is made of plywood. In the swamps along the rivers and near the sea grows the cypress, suitable for interior finishing of houses and for making the best shingles.

Easy lumbering. It is doubtful whether any logs in the world are easier to get than the splendid stands of hard pine on the almost level, sandy plains in parts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and eastern Texas. Temporary railroads (Fig. 45-B) can be laid easily, to which horses or engines drag logs and load them on flat cars.

Fig. A. Long-leaf yellow pine in our Southern States, a noble timber tree. Why the white scars on the trees?

For more than a hundred years these fine forests have supported the naval-stores industry, supplying many countries with resin and turpentine.

Decline of lumbering. Because of overcutting, fire, pasture of cattle, and of pigs that eat the roots of little trees, lumbering in this region has passed its prime. The cut of 1909 was greater than that of 1928, but recent successful experiments at making paper from seven-year-old pine trees promise a new era of profitable forestry. Florida has one paper mill where 1500 men turn 600 cords of wood each day into paper for corrugated-board containers.

The pine of Brazil. In Brazil, back of the coast range, between latitude 18° and 29° south, is an area of about 300,000 square miles of forest with quantities of a tree called *Paranó pine.* Some of the trees are 165 feet high. Average matured trees measure about three feet in diameter, and yield four or five logs sixteen feet long. Commercial lumbering has made only a small beginning in this great area, which is now giving Brazil a small lumber export.

The quebracho of the Paranó Valley. Paraguay

and the near-by parts of Argentina export quebracho logs and extract which have recently become so important in tanning leather in Europe and America (page 262).

The forests of Japan and of China south of Shanghai. The forests of the southern highland of China (Plate XVIII) resemble those of the part of North America having similar latitude and climate. Where is that? (Fig. 2–3-A.) I have seen many a raft of logs floating down the Min River to Foochow, there to be loaded on junks (sailing vessels) bound for Shanghai and Tientsin.

South Africa and Australia. What parts of South Africa and Australia have a climate similar to that of the state of Georgia? How large are these regions? In each of them, between the mountains and the sea, are sections where the forest is of mixed pines and hardwoods, but the areas are too small to be of great commercial importance.

Tasmania and the moister parts of Australia have a family of trees called eucalyptus. They comprise many species. Some are of great value as timber trees; they grow with great speed, and have been introduced into all parts of the world having the Mediterranean type of climate. Australia exports some eucalyptus wood called *jarrah* and *karri*, but, because of the differences in quality, she also buys much lumber from the United States.

THINGS TO DO AND QUESTIONS TO ANSWER

Widely scattered regions. **1.** Kinds of trees found in southern United States: (*a*) Name the kinds; (*b*) Is it easy to get timber here? (*c*) Name the by-products of these trees; (*d*) Name and locate the leading lumber-producing states of this region; (*e*) What is meant by "naval stores"? (*f*) What is likely to be the future for this region?

2. What are the important things to tell about lumbering in the Southern Hemisphere? about lumbering in China?

3. Look through this chapter and see what pictures you can use to illustrate a talk about (1) a two-job man; (2) forestry; (3) lumbering; (4) wastefulness; (5) hard work; (6) easy work; (7) thrift; (3) a good plan; (9) different kinds of climate.

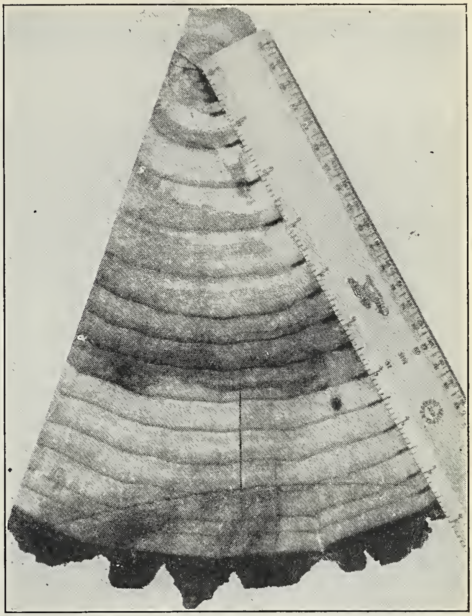


Fig. A. Part of cross section of a tree of one of the hybrid poplars widely planted as a shade tree in the United States. This particular tree grew at Rumford, Maine. In seventeen years it had reached a diameter of seventeen inches. Some tree hybrids produced artificially grow even faster than this one. This is one of the great hopes of forestry.

Fig. B. Tell the story of this one-time fine long-leaf pine forest in Louisiana.

4. A tree can make a million matches; one match can kill a million trees. Tell about the ease of getting timber from land like this and from land shown in Figures 21-A; 46-A; 50-B; 54-A; 56-B.

Fig. A. Mass production of lumber. A great lumber enterprise in Washington State owned by a company that expects to grow its own timber on its own land and keep this up permanently. Find the pond where the logs are dumped from cars, log canal, log-storage pond by mill, lumber piles, lumber sheds, wharf for ocean steamers. Many railroad tracks run through this plant.

UNIT 6—THE FORESTS OF THE PACIFIC COAST OF NORTH AMERICA AND THE ROCKY MOUNTAINS

A THOUGHT MAP. Take a map of the world and put on it several large imaginary islands on which the Big Trees of California should grow.

Forests without a peer. Northern California, Oregon, Washington, and British Columbia have the finest forests in all the world. The redwood, called *Big Trees*, and the Douglas fir furnish the largest trees and the tallest forests in the world. The long trunks, standing close together, produce more lumber to the acre than any other forest.

The logs are too big to be floated. For the most part they are dragged from the woods by donkey engines and hauled by trains to great storage ponds (Fig. 54-A). From the ponds the logs are dragged by engine power against the sharp gang saws of the great mills that manufacture lumber on tidewater. From the mills lumber can be loaded on steamers, to go by ship to southern California, South America, Japan, and China, through the Panama Canal to our Atlantic coast and to Europe. In a recent year British Columbia shipped lumber to thirty-five states in the United States. The Pacific coast forest is now the great lumber export region, producing much more than it did twenty years ago, and possessing by far the greatest lumber reserves in the United States.

The so-called "big trees," the redwoods, are of the sequoia species. They once grew in Europe and Asia, but the glacial epoch destroyed all of them, except those in America. To what sections of the world do you think they might be introduced? In almost a hundred years young trees

Fig. A. Forests without a peer. Clearing a road through one of our national forests in the Sierras.

transplanted from California to England have attained a diameter of seven feet.

Forest that will not burn. The coast forest of Alaska, with spruce, hemlock, and cedar, is in land so damp that the forest will scarcely burn. This is fortunate. The forest extends only 2000 feet up the mountains and covers a rather small area. But it has enough rain to keep the trees growing nicely. It would produce several hundred tons of paper a day as long as the forest were cared for. There is splendid water power near Juneau and elsewhere to supply power for paper mills.

Similar forests of small area can be found in the corresponding area of mild, damp climate in western Norway, southern Chile, and southern New Zealand.

The forests of the Rocky Mountains. These mountains, rising from treeless plains, have thousands of tracts of evergreen forest, small and large, scattered on their slopes and in their valleys. Most of it is in national forests and much of it cannot be got out at a profit.

Similar forests in Eurasia. The Caucasus, the mountains of Persia, and the many mountains of central Asia are much like the Rocky Mountains in respect to forest, except that pasturage has reduced the forest area in many places.

A world problem. Many countries, including the United States, are using more lumber than is being produced. Where will they get their future supply? The four largest forest owners are U. S. S. R., the British Empire, the United States, and Brazil.

THINGS TO DO AND THINK ABOUT

Tall trees. 1. The ———, ———, ——— furnish the largest trees and the tallest forests.

2. How are large logs handled?

3. How important is this region as a lumber exporter?

4. Study carefully the pictures of tree scenes in the western part of our country and tell what you want the state legislatures, the Government at Washington, and the American people to do.

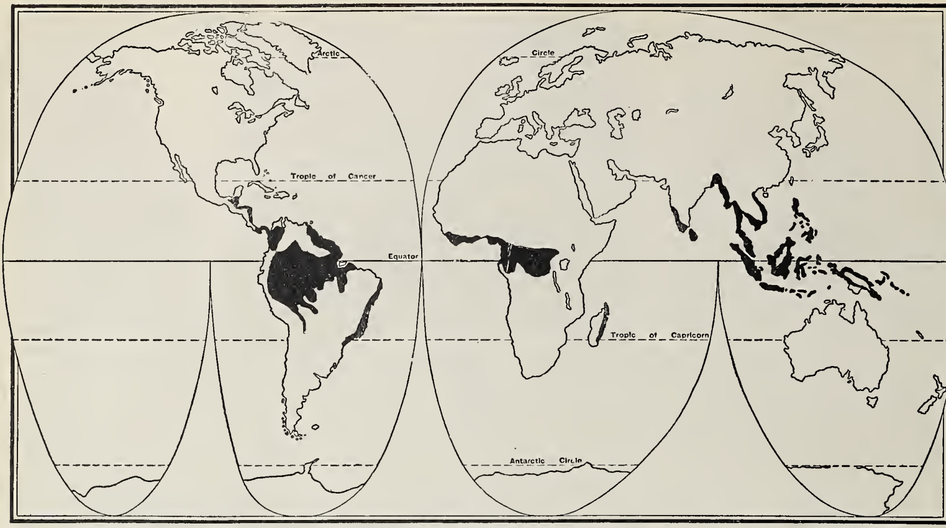


Fig. A. The solid black areas on this map show the locations of the tropical rain forests. Find these forest lands also on Figure 2-A.

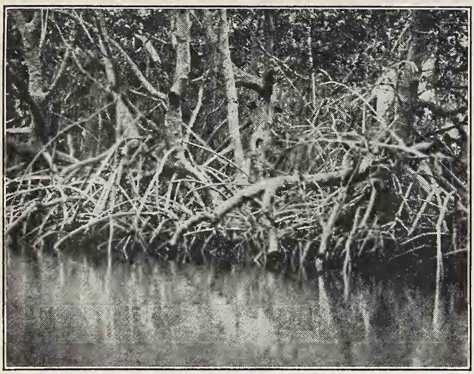


Fig. B. This Florida scene shows the mangrove tree, a lover of tropic shores where the water is quiet. Tell about going through it or getting wood out.

UNIT 7—THE TROPIC FORESTS

> Lumber Exchange. Explain why lumber dealers in towns in tropic forests where ships can go sell more lumber from the forests of frost land than from their own near-by forest.

Rich in variety. Tropic forests cover large areas in widely scattered regions and have many species of hard and beautiful wood. Some species are so hard that it is difficult to cut or work them. Some are so heavy that they will not float. The good trees are usually scattered, a tree here and a tree there, among many trees with soft and worthless wood. The trees are often bound together by a tangle of climbing vines (Fig. 57-B). In the rainy season large areas are flooded, and larger areas are so soft and muddy that the use of wheels is impossible. Logs are often dragged over the slippery earth.

Only three important woods come out of all the tropic forests. From eastern Mexico, Central America, the West Indies, and parts of West Africa come mahogany, used for furniture, and soft cedar for making pencils. From the forests of Burma, Siam, and Indo-China comes teak, valuable for shipbuilding. In these Asiatic countries the useful elephant often helps with this work (Fig. 186-A).

THINGS TO DO AND QUESTIONS TO ANSWER

1. Look carefully at the forest in the picture with the leopard in it and then at some other forest pictures. Tell about it as a place for lumbermen; for monkeys; for birds.

2. What countries are located in tropic-forest regions? Locate each.

3. Name the chief woods found in this region and their uses.

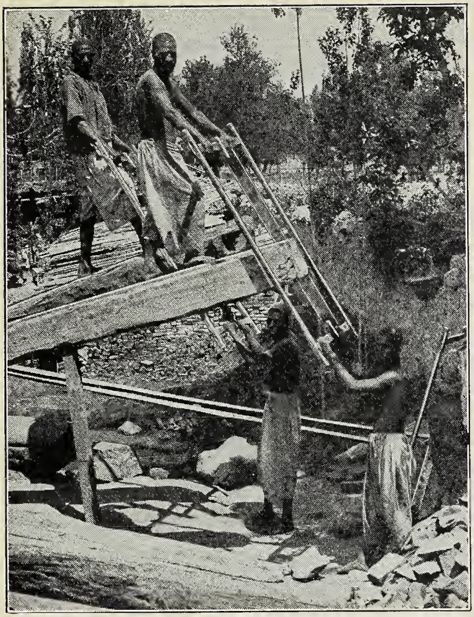


Fig. A. This method of sawing lumber is common in many lands. Where the population is dense, lumber is costly and men are cheap. I have seen it in China, Japan, and India.

4. Tell the important things about the lumber industry in these forests.

CHAPTER SUMMARY

Get the forest map into your mind. **1.** Show on an outline map of the United States areas where leading kinds of wood are produced.

2. Do the same for a map of the world.

The future supply of wood. **1.** Make a careful study of what the United States Government is doing to improve forests. Get list of publications from United States Forest Service, Washington, D. C. Be sure to get this book, *A Forest Fire Prevention Handbook for School Children*, and send to the Canadian Department of the Interior, Ottawa, Canada, for *Historical Sketch of Canada's Timber Industry*, by James Lawler.

2. Do the same for your own state. Write to the State Forester at the state capital.

Studying a picture. Examine carefully Figure 50-B and write something about (*a*) the amount of wood we have now; (*b*) the distance we once had to carry it, and the distance we now have to carry it; (*c*) forests and soil erosion; (*d*) the evenness of stream flow for boats and water power; (*e*) forests and floods.

Extra credit. Explain how forests make trade because of differences in (1) rainfall; (2) temperature; (3) character of land surface; (4) density of population. Give an example of each.

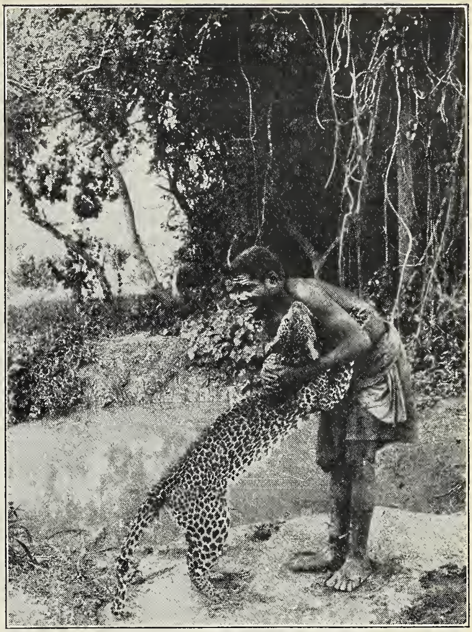


Fig. B. A tropical forest in the Belgian Congo. Compare getting a log out of it and out of the forest in Figure 52-A. The Congo Negro has a pet leopard.

Fig. C. The warm wet lands of the Florida Everglades.

Graphs. **1.** What do Table 3 and Table 6 (Appendix) tell you about the influence of industrial depressions on the lumber business?

2. Rags have been used for making paper for a very long time. Wood pulp is a new method. Look at Table 5 (Appendix) and make an important graph.

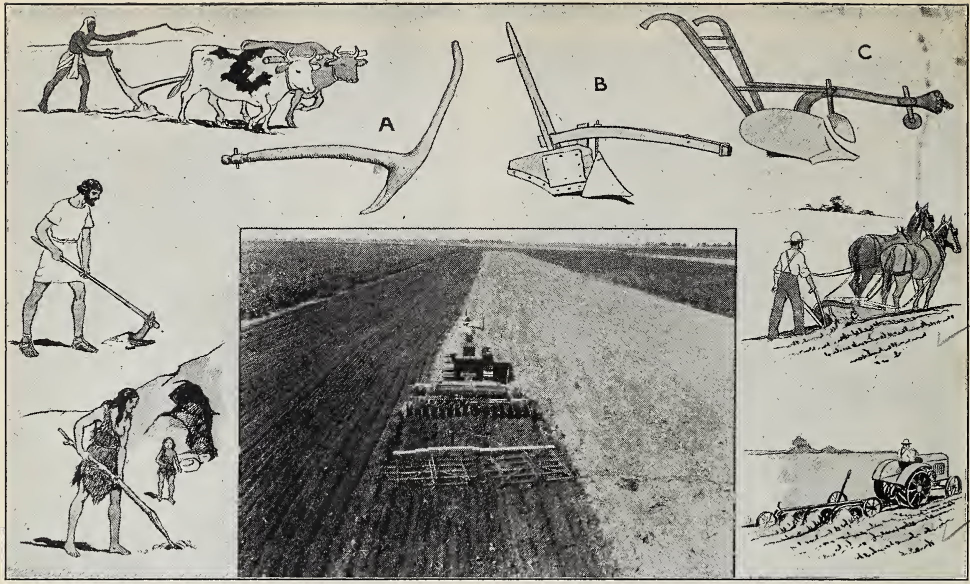


Fig. A. Preparing the soil for the seed. Primitive man dug a hole with a stick or a stone hoe in which to plant his seed. After he had tamed animals, he used a forked branch of a tree (A) as a plow. Later—much later—came the wooden plow with an iron share (B), and then the modern steel plow (C). Guiding this plow behind a team of horses was all the work one man could do. But with a tractor, he can manage twenty or more disk plows, as you see in the center picture, all working at once if the ground is smooth and level.

CHAPTER IV

AGRICULTURE AND ITS SERVICE TO MAN

UNIT 1. MANY STAGES, MANY HELPERS, MANY CONDITIONS

A SOIL TEST. Put widely differing kinds of earth in separate jars—half full with earth, four fifths full with water. Shake thoroughly. Let stand overnight. Without touching the jars, tell what you see about the different samples and their qualities for the farmer.

The beginnings of agriculture. The wandering natives of the interior of Australia, who live without beast of burden, field, garden, crop, or house, often gather armloads of certain plants and sit by the campfire for hours, picking out the seeds and eating them. This is a very, very old way of getting a meal. Naturally, some seeds drop by the fire and sometimes they sprout and grow. When the wanderers return to the old camp site, they perhaps find a crop of these plants, with seed ripe for harvest. Farming may have begun in this way. It happened in many different places and so long ago that many plants have been so changed by cultivation that we no longer know their wild forms. Some plants, such as the cultivated banana, no longer produce seed.

In its long history agriculture passed through several stages.

1. Primitive agriculture. In every continent save Australia, man long ago developed what is called *primitive agriculture.* By chopping and burning the trees and bushes, he made clearings in the forest. There, with the aid of a sharp stick, primitive man or woman planted seeds and roots, pulled the weeds away from the plants, and later gathered the crop. The family labored without the assistance of any beast of burden.

Fig. A. Sowing the seed. Tell how the seed is being sown in each picture. At the lower right is a machine, called a *drill*, which sows many rows of seed at one time. In the center the big tractors are pulling *listers*—machines which dig furrows, plant the seed, and cover it, all in one operation.

After a few seasons the family moved its garden to a new place, and presently the whole village no doubt moved for the sake of getting nearer to fresh garden land.

This migratory *patch farming* can be seen today in the tropical forests of South America, Africa, the hills of southern India, Siam, the East Indies, and parts of the Philippines. Most of the Indians in the United States farmed in this way.

2. The beast of burden and the plow. When man had tamed the ox, the horse, the donkey, and the buffalo (Fig. 92-A), he put a thong of rawhide across the stout shoulders of the animal and fastened the branched trunk of a small tree to the leather thong. The beast pulled the tree trunk and the man guided it in such a way that its sharp end scratched the earth. Thus was the first plow invented, and another stage of agriculture begun. Farming with the aid of animals enabled our ancestors to have permanent homes, barns, villages, and even towns.

3. The domestic era. In the time of George Washington, most of the farms of the world were parts of what is sometimes called the domestic system. This means that each farm produced nearly everything that the family used. Farms in the days of Nebuchadnezzar differed but little from those George Washington knew. There are millions of such farms in China even now.

4. Commercial agriculture. In the very new and young age in which we live—the age of machinery—an entirely new kind of farming has developed. Railroads, ships, and trucks enable the farmer to send his surplus to distant markets and to receive goods that he needs but does not produce. The farmer may grow two or three crops, or even perhaps only one crop, most of which he sells to some distant market; with the money he receives he buys things that he uses, including much of his food.

Where can man farm? All farming depends upon plants. The farmer may sell nothing but meat, but all land animals, as well as those of the sea (page 13), live on plants. Man can farm only in those places

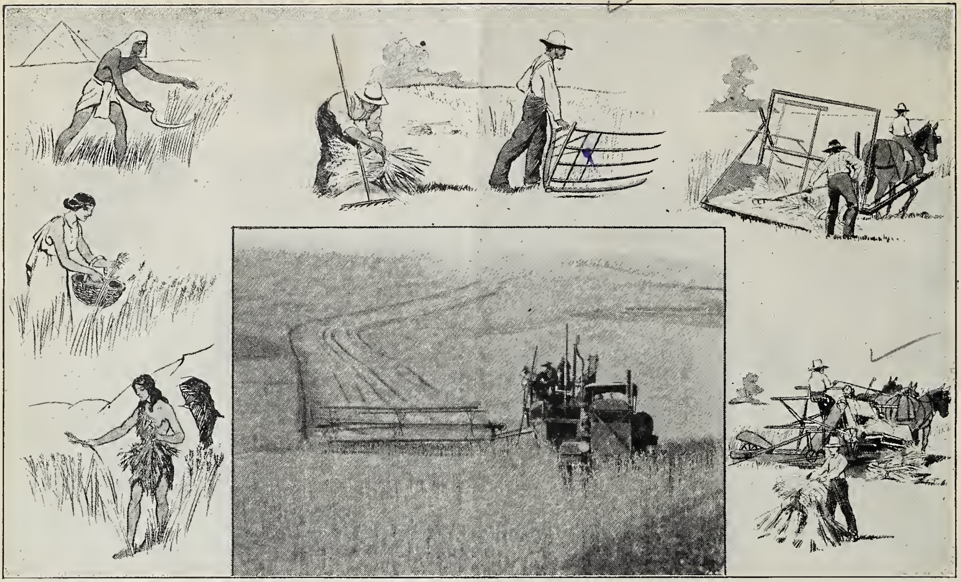


Fig. A. Reaping the crop. Tell how the two women at the left are reaping the grain. Why do you think the cradle is a better reaping tool than the sickle? the reaper than the cradle? the reaper and binder than the reaper? See the wide swath which the big header has cut in the field of standing grain.

where many plants grow. An important part of agriculture is the taming of wild plants. Plants that will make profitable crops must have some part that is of use to man. Other plants (weeds) must be kept away from the plant that is useful to man. Plants require a number of conditions in order to make a crop and a farm. Let us examine some of these conditions.

Fig. B. This Michigan potato field had 500 pounds of fertilizer to the acre on the part where the boy stands. In an Illinois experiment, 175 pounds of fertilizer, containing nitrogen, phosphorus, and potash, increased the yield of wheat from 660 pounds to 1410 pounds an acre. In large areas of western Europe crop yields have been doubled, since I was a boy, by use of fertilizer and by other scientific means.

1. Heat and sunshine. All plants need heat; some need more than others, or need it for a longer time. The different length of the growing season often decides what crops can or cannot be grown. Because of the lack of heat, many lands are too cold for agriculture. No crop but pasture grows in the Arctic tundra region, or on high mountains. Because of the short growing season, some lands, like high mountain valleys, have plenty of heat for part of the time, but the period between frosts is too short to mature any crop but grass. Such valleys may produce good pasture or hay. Some plants need more sun than others. Sun gives color and sweetness to fruit. Cloudy locations are not good fruit districts, but some grasses do well in cloudy weather. Cacao requires shade, and mushrooms grow well in dark cellars.

2. Moisture. For want of moisture,

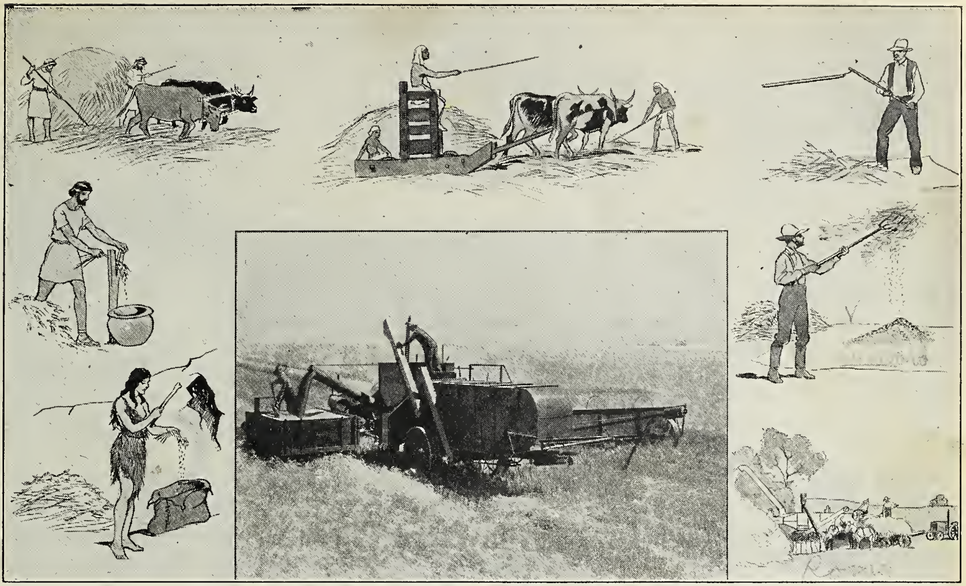


Fig. A. Threshing. In the center is a *combine* which reaps, threshes, and pours the grain into a wagon alongside. Tell something about each of the other methods of threshing shown in these pictures.

many lands are desert or poor pasture. In our own country there is little farming in lands having less than twenty inches of rainfall a year. If there is too much water, land may become a swamp. Most swamps are not used for crops, but the Chinese and Japanese have found that rice and some other crops prefer to grow in swamps or even in ponds of water.

3. *Fertility.* Plants, like animals, must eat. They get food from water, air, and soil. Soils differ greatly in the amount of plant food that they contain.

Crop rotation helps to maintain the fertility of the soil. By growing certain crops one season and different crops the next, the several kinds of plant foods may be utilized. If there are legumes in the crop rotation, they leave nitrogen, which is gathered in nodules on the roots (Fig. 97-B) by certain minute bacteria.

Within the last century, man has discovered what foods the different plants need. Nearly all soils produce better crops if nitrogen or phosphorus or potash is added (page 196). Some soils need all three. The best of all fertilizers is barnyard manure, but this can rarely be had except on stock farms. Commercial fertilizers (chemicals) are now manufactured and contain plant foods. They are used in many countries. It is also very important that soils should have *humus*, decaying vegetable matter such as can be seen under the rotting leaves in a forest. Crops are sometimes grown and plowed under for their humus and fertilizer value.

Soils containing much lime are *alkaline* and suit the clovers and many other crops. Soils having little lime are *acid* and suit another type of crop plants.

4. *Other soil qualities.* To be suitable for crops, soil must be *permeable*, that is to say, water, air, and plant roots must be able to go through the soil easily. If you will examine a piece of pure clay when it is dry and again when it is wet, you can see why plant roots, water, and air may have difficulty getting through clay. If soil is sandy, it is too permeable and water runs

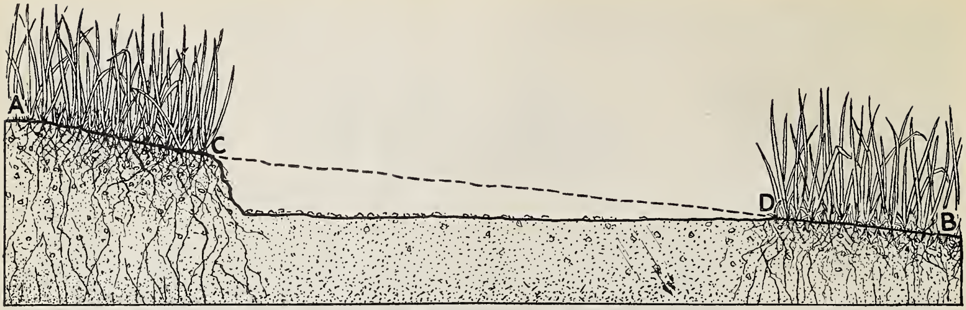


Fig. A. Water running rapidly down steep slopes of bare land cuts gullies, but the little raindrops also move land downward toward the sea. Their work is often called *sheet erosion.* Here is a small sample. My yard has a gentle slope, as from A to B. A thick sod held the ground firmly in place. An automobile dropped some oil, killing the grass from C to D. The roots no longer held the earth, and the poison from the oil let no plant grow. In less than two years the pattering raindrops dug out the little particles of dirt and splashed them away, so that the ground from C-D was about level and was covered with the tiny pebbles which had been scattered through the earth material that had lain between C, D, and B. This goes on in every plowed field where the land slopes.

through it almost as easily as it does through a sieve. Even in countries such as New England, small tracts of very sandy land are not used for farms and are called deserts by the people who live near. Mixtures of sand and clay, called loams, are the best soils for agriculture. If these mixtures are largely of sand, they are very easy to plow and cultivate.

The character of the soil depends in part upon how the soil was made. Rocks are broken and become soil by mechanical means, such as freezing, heating, and cooling, and by the action of plant roots. Rocks become soil by chemical means. For example, the acids of decaying plants eat out one element in a rock and let the rest of it fall to pieces—sand and clay. If soil is made from the rocks that once lay where the soil now lies, we say it is a *residual soil.* If water moved it, it is called *alluvial soil.* If soil is made of material that settled in the bottom of a lake, it is called *lacustrine soil.* It glaciers moved it, it is called *glacial soil.*

Surface. Land that has too many stones upon it cannot be plowed. If it is too steep, it cannot be plowed easily or if it is plowed, it washes away. Therefore there is but little farming in mountains, for much hilly land has been ruined by soil erosion (Figs. 73-A and 200-A) when plowed.

As we study the various crops and countries of the world, we shall see that, because of drought, cold, swamp, poor soils, rocky soils, and steep land, most of the earth's surface is not good for farming; therefore most of the people live on the small fraction of the earth's surface that is suitable for farming.

THINGS TO DO AND QUESTIONS TO ANSWER

What? Why? Where? How? 1. Why can no man tell when or where agriculture began?

2. What are the stages through which agriculture has passed? Can all be seen today? Where?

3. Find pictures in other parts of this book that illustrate things mentioned in this chapter.

4. Explain why most of the people live on a small fraction of the earth's surface (Fig. 2-A).

5. What is necessary to make plants grow?

6. How can man keep the soil fertile?

7. What industry—farming, fishing, mining, lumbering, or ranching—prevails in regions of dense population? Explain.

Class reports. 1. Look up information about *one* of the following topics and make a report for your class:

(*a*) The life and work of Cyrus McCormick.
(*b*) The United States Reclamation Service.
(*c*) The United States Bureau of Soils.
(*d*) The fertilizer industry.

Your school museum. 1. Collect samples of the soils in your locality and test them.

2. Make a model of the primitive plow.

3. Collect and arrange pictures showing the development of agricultural tools and machines.

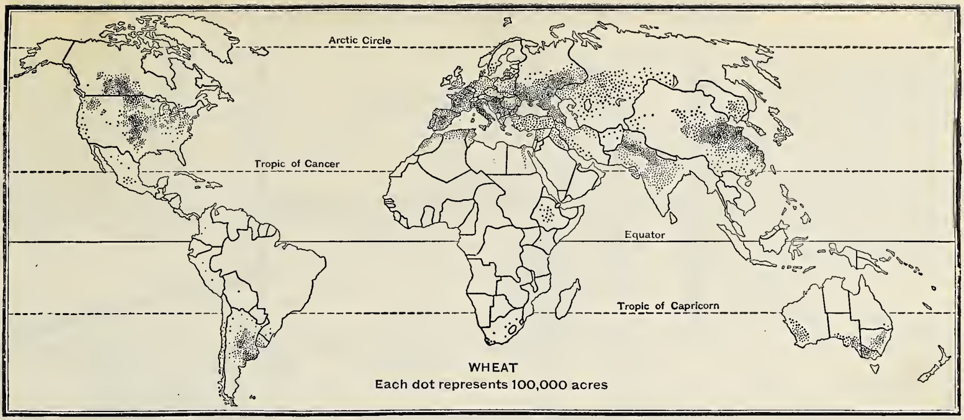


Fig. A. A world map showing the acreage planted to wheat in different parts of the world. Each dot represents 100,000 acres in wheat.

CHAPTER V

WHEAT AND OTHER SMALL GRAINS

UNIT 1—MACHINE REPLACES MUSCLE

A Problem in Power. Make some graphs that show the amount of land a man can plow by different methods.

Wheat and bread. All the grains are good for food and are alike in the nourishment they provide. But wheat, one of the domesticated grains, has long been the favorite breadstuff of many peoples in many parts of the world. Its popularity is increasing year by year.*

Plowing for wheat. To grow wheat, man first plows the land to destroy rival plants and to loosen the soil so that the roots can penetrate it. The sharp stick, the wooden spade, and the wooden plow were used for a very long time. The iron plow has been in use only about 150 years. Then followed a gang of plows, drawn first by horses and later by tractors. Now, in a day, one man can plow more land than a dozen men could plow at the time of Caesar or even of George Washington.

Sowing the seed. Changes have come in methods of seeding. First the work was done by hand (Fig. 59-A); then by the drill drawn by animals; later by a battery of drills drawn by a tractor.

Harvesting. Figure 60-A tells about harvesting wheat. The reaper of 1831 passed through many stages before it finally became the great machine shown in Figure 60-A.

Threshing. Separating the grain from the straw and chaff was also laborious work. The grain was sometimes beaten with flails (Fig. 61-A). The Bible speaks much of the threshing floor where animals walked upon the grain and shattered it out of the heads (Fig. 61-A), and people winnowed in the wind (Fig. 61-A).

A machine called a thresher which could thresh more than a thousand bushels a day was a great step forward. Drawn by a tractor, the thresher visits farms in the wheat-growing neighborhoods of America and Europe. The thresher has been superseded in important wheat regions by the combine (Fig. 61-A).

Grinding. Grinding grain into flour was doubtless first done by beating or rolling

* Note to Teacher: It is very important that the class have access to a copy of *Yearbook of U. S. Dept. of Agriculture*. This book has a great wealth of up-to-date statistics on production and can be had free by applying to the Congressman of your district.

1—Scales for weighing wheat as it is received.
2—Receiving separator, for separating other kinds of seeds from wheat.
3—Storage bins, for reserve supply of wheat in advance of mill requirements.
4—Mill separator, for further separating foreign seeds from wheat.
5—Scourer, for removing dust from wheat kernels.
6—Cockle cylinder, for removing all round seeds.
7—Wheat washer, for thoroughly cleansing the wheat.
8—Wheat dryer, for drying wheat after washing.
9—First break rolls, for rupturing bran, enabling bran and germ to be separated from interior.
10—First break scalper, for sifting middlings through bolting cloth to separate from bran.
11—Second break rolls, for further loosening the middlings from bran.

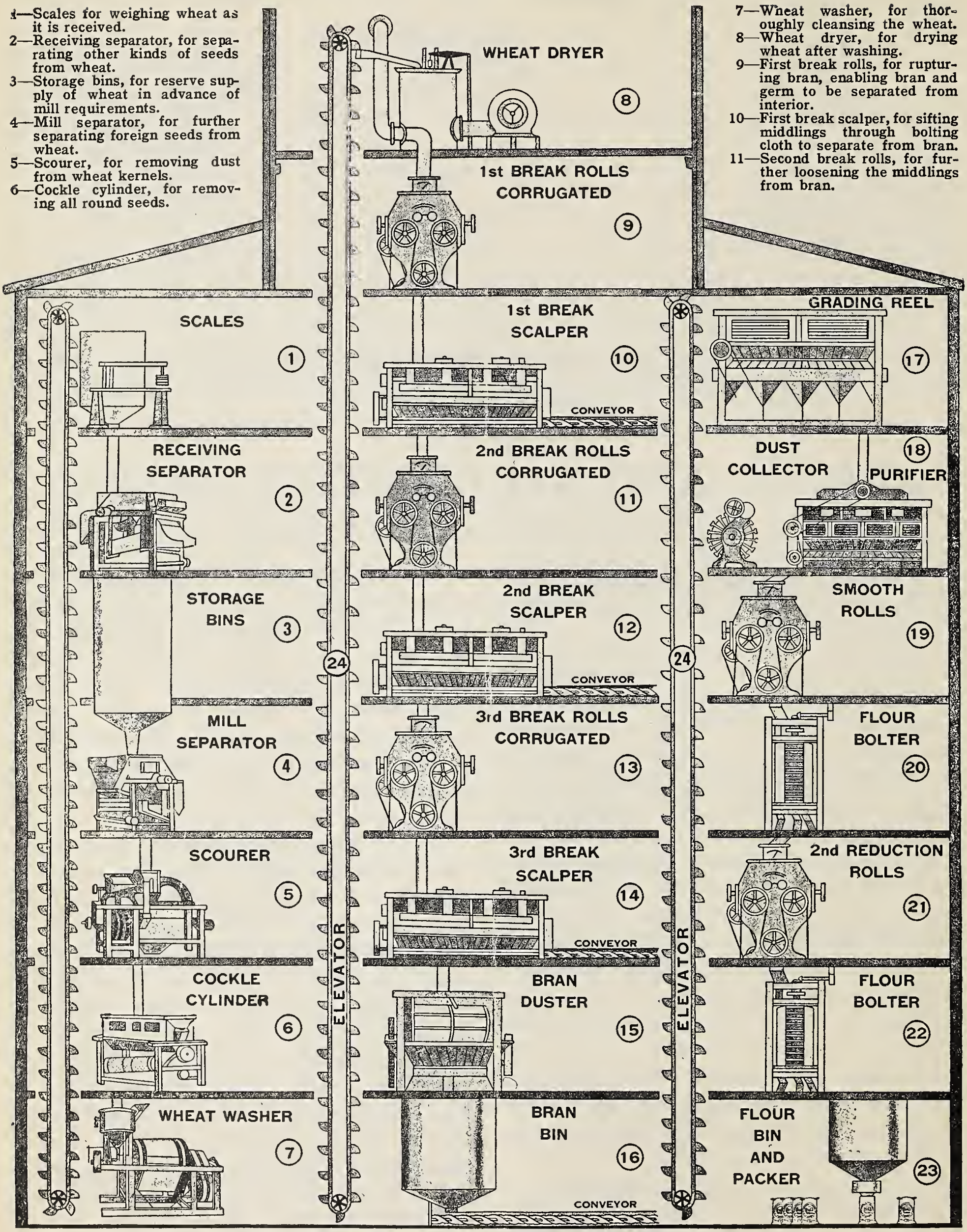


Fig. A. Cross section of a modern roller-process flour mill.

12—Second break scalper, for separating more middlings from bran.
13—Third break rolls, for further loosening middlings from bran.
14—Third break scalper, for final separation of middlings from bran.
15—Bran duster, for dusting low-grade flour from bran.
16—Bran bin, for packing bran for shipment.
17—Grading reel, for separating middlings by sifting through various sizes of bolting cloth.
18—Dust collector and purifier, for cleaning and purifying middlings by air and sifting.
19—Smooth rolls, for grinding purified middlings very fine to flour.
20—Flour bolter, for sifting flour from purified middlings.
21—Second reduction rolls, for further grinding of purified middlings.
22—Flour bolter, for separating flour from purified middlings of second grinding.
23—Flour bin and packer, for packing flour for shipment.
24—Elevator, for raising products to the various machines.

the grain between two flat stones. When I rode into the town of Nazareth, in Palestine, and stepped up to a doorway to inquire my way to the house where Jesus had lived, there, on the floor, sat two women facing each other and grinding wheat as wheat has been ground for ages.

Making water wheels turn stones was merely an enlarged form of the ancient stone hand mill that I saw in Palestine. Water-ground flour was made a hundred years ago in ten thousand country mills from Maine to Georgia and Missouri. Machinery that is almost automatic now grinds grain in the great milling centers (Fig. 64-A).

Wheat climates. Fortunately, wheat grows in several types of climate, in all inhabited continents, and in many countries. But there are many other countries where wheat does not grow.

The wheat plant is probably a native of the Mediterranean region, where wheat has been grown for ages and where the climate seems to suit it perfectly. Examine the maps (Figs. 63-A and 66-A) and the climate graphs on Figure 2-A to see the facts of the Mediterranean type of climate. Note its distribution throughout the world. In winter there is some frost, but the temperature does not stay at or below the freezing point long at a time.

Wheat gets along very nicely on 20 to 30 inches of rain in a year, sometimes on less, especially if there is a rainy season when wheat is growing. Several very different types of climate permit a wheat crop to grow at some time during the year.

In lands with the Mediterranean type of climate wheat is sown in autumn just after the early rains moisten the soil. Autumn-sown wheat is called *winter wheat.* Since wheat can stand some frost, it grows in the sunny days of winter and early spring. If planted in heavy, dark, rich soil, a single plant becomes a stout bunch of grass. In the early spring the plant throws up stalks, one or many, forms its heads, and blossoms. Wheat does best if there is no rain after the blossoming period. With a few weeks of continuous sunshine, the plant will make large, fat seeds, full of food for little plants, for animals, birds, and men.

Wheat in the Mediterranean countries. Wheat has been the chief food of the people in every country on the Mediterranean Sea for more than three thousand years. This excellent food helped those countries to become populous and civilized at an early time. Today wheat is grown as extensively as ever.

I have seen wheat growing in Spain and in Syria on hillsides so steep and so rocky that it was impossible to plow them. Men dug the earth between the rocks with hoes, and sowed the wheat by hand in places where it had to be cut with a sickle. In 1930–34, during the great unemployment, Italy kept many of her unemployed at work reclaiming mountain sides and swamps for new wheat fields.

THINGS TO DO AND QUESTIONS TO ANSWER

Making up questions. Make up five questions for your classmates to answer telling of the changes that have been made in growing wheat. Be sure you can answer your own questions.

Finding definitions. Find in your dictionary a definition for each of the following words and be able to use them in sentences:

1. plow	4. harvest	7. portable	10. scythe
2. grind	5. thresh	8. shattered	
3. automatic	6. drill	9. sickle	

On an outline map of the world. Show the areas that have a Mediterranean climate. Color these regions green. Compare your map with Figure 66-A. Which country of the Mediterranean climate raises the most wheat?

What, when, and how. 1. What quality does wheat possess that makes it man's favorite food?

2. When is winter wheat sown? During what months is it harvested?

3. How did Italy take care of some of her unemployed in 1930–34?

Changing methods. Choose four members of your class. Let each pretend he is a farmer in one of the following periods: in the time of Cæsar; after 1806; after 1831; or today. Each should tell how he would plant, harvest, market, and grind his wheat. Use the pictures in the text and material from the library to make the talks interesting.

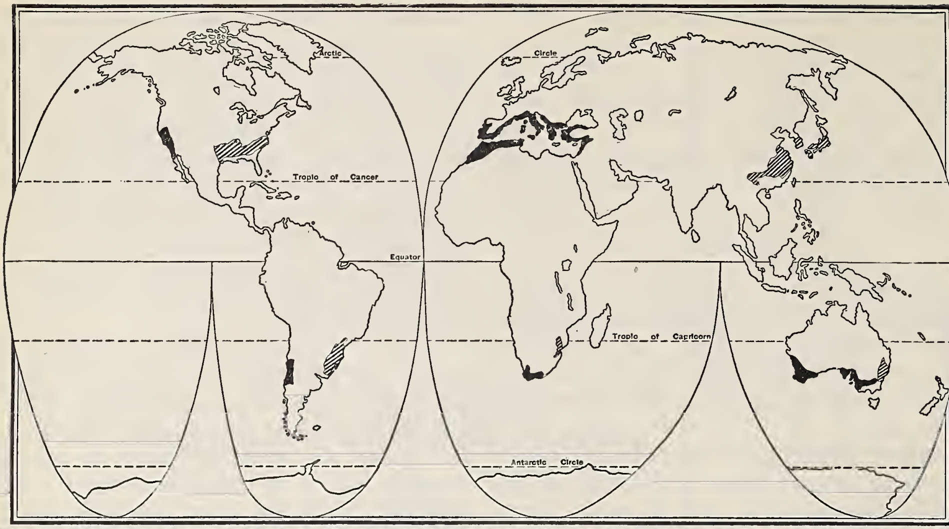


Fig. A. The areas shown in black on this map represent lands having the Mediterranean type of climate—cool, rainy winter, some frost; summer almost rainless. Find these areas on Figure 2-A. The line-shaded areas are good for cotton, corn, and rice.

Fig. B. Where Chile and Argentina would be located if each country had the same latitude in North America that it has in South America.

UNIT 2—WINTER WHEAT IN OTHER LANDS OF MEDITERRANEAN TYPE OF CLIMATE

Locations and Pictures. Make a sketch map of the world showing clearly all the areas having the Mediterranean type of climate. Make graphs like Figure 28-B for Sacramento, California, and Santiago, Chile (see Appendix).

California. How does the climate of California compare with that of Spain? Italy? Palestine? central Chile? the southwestern part of Cape of Good Hope Province? Adelaide, Australia? northern Algeria?

When you consider climate, you can easily understand why the Spanish settlers in California took with them wheat and other Mediterranean crops, and why these crops thrived in their new home. After California became a state, great wheat fields soon spread over its valleys, and ships sailed by hundreds from San Francisco taking wheat around Cape Horn to our eastern coast and to Europe. But California does not now use her land extensively for wheat. Her population has grown rapidly, and now, like the countries on the Mediterranean, her people consume more wheat than they produce.

Chile. What does Figure 66-B tell you about the likeness of California and Chile? Like California, Chile has a coast range of mountains which are low like the coast ranges of California; an inner range, the Andes, which are high like the Sierra Nevada of California. Like California, Chile has a great valley between her two mountain ranges. This great valley, like that of California, was early planted to wheat. Like California, its wheat area is comparatively small. Chile has never been an important exporter of wheat.

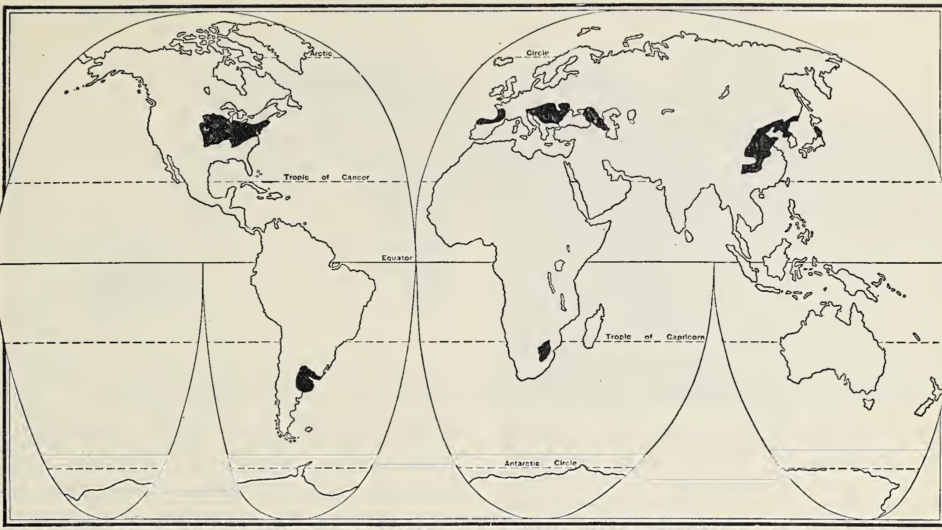


Fig. A. The areas in black on this map are good for corn and winter wheat. Find these areas also on Figure 2-A.

South Africa. The southern tip of Africa has only a little land with the Mediterranean type of climate. It suits wheat; but not enough wheat can be raised to meet the needs of the Union of South Africa.

Australia. Each year of good harvest sees wheat ships sailing from Perth and Fremantle in Western Australia, from Adelaide in South Australia, from Melbourne in Victoria, to make the long, long journey to the wheat docks of Britain and neighboring countries in northwest Europe. How does the area of land in Australia having Mediterranean type of climate compare in size with other areas having this type of climate? Perhaps you can explain why Australia has a substantial export of wheat, while South Africa does not.

THINGS TO DO AND THINK ABOUT

A comparison. In how many ways may Chile be compared to California?

Wheat importers. The United Kingdom, Germany, Italy, and France are the world's greatest importers of wheat. Can you tell why?

Finish the graph. Make a bar graph similar to Figure 20-B showing the annual production of wheat in several leading countries; in several leading states.

UNIT 3—PERSIA AND INDIA, EGYPT AND MESOPOTAMIA

Fitting a Crop into the Climate. Explain how it is that India and Sweden have a similar problem in growing grain.

Resemblance to Mediterranean winter. Compare the latitude of Persia with that of Palestine. It so happens that the same winds that bring winter rain to Palestine also bring winter rain to Persia. The Persian winter is colder, but not too cold to interfere with the growth of winter wheat.

Some of the same storms (Fig. 79-A) that bring rain to Palestine and Persia go on to northern India, and make the upper Indus Valley an important wheat region.

The Indian plateau near Bombay. In this plateau the winter season during which the weather is cool enough to suit wheat is very short. A slow-growing variety would perish from too much heat before it ripened. By using a fast-growing, early-maturing variety, the farmer actually gets his crop rushed to maturity between October and February.

Explain. Why is wheat growing in Egypt, Mesopotamia, and India limited to relatively small parts of those countries?

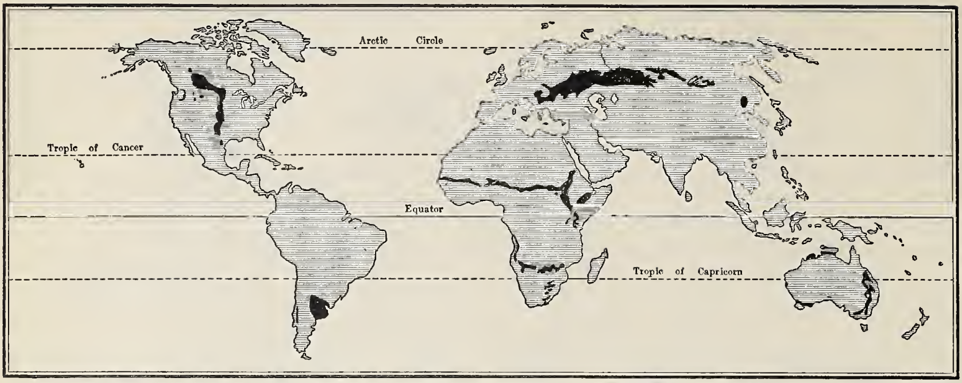


Fig. A. The black-soil belts of the world about which you will read on this page and page 69.

UNIT 4—WINTER WHEAT IN LANDS OF MOIST WINTER AND MOIST SUMMER

Ideas and a Map. Put on a sketch or outline map of the world the main black-soil belts (Fig. 68-A). Add to it the line (isohyet) showing 20 inches of average rainfall. On the drier side of this line put, in their right places, some small drawings of sheep; on the rainier side some trees in the right places.

I. United States

Wheat and the climate between New England, Nebraska, and Texas. In Virginia, Pennsylvania, New York, and states to the west including Nebraska and Texas, wheat is sown in autumn, as in the Mediterranean lands, but it must be sown rather early, that the plants may become well established before winter sets in. Wheat in this region prefers some snow; snow acts as a blanket to keep away the cold wind and the frequent freezing and thawing of what is called an open winter.

A heat-moisture boundary. This wheat region is limited on the south by summer heat and moisture. When the wheat plant is forming grain and ripening seed, it does not like heat, moisture, and rain. These conditions seem to interfere with the formation of good full grains and they encourage the growth of fungi called *rust*. Compare the wheat yield in Georgia with that in New York or Washington (Appendix). In the year of the greatest known drought (1930) many counties in Pennsylvania, Maryland, Virginia, and Kentucky had the finest wheat crop in years because the droughts of May and June, which ruined the corn, grass, and hay, suited wheat perfectly.

Wheat in rotation. In this wheat region more than half of the farms are from 50 to 250 acres in size. The farmer nearly always has a *crop rotation.* For example, in a popular three-year crop rotation, a field will be in wheat this year, clover next year, and then corn. Or, the farmer will sow two kinds of grass in the wheat, and have a five-year crop rotation: (1) wheat, (2) clover, (3) timothy (or orchard grass), (4) timothy (or orchard grass), (5) corn. On most of these farms some form of live stock is kept—dairy cows, sheep, hogs, or cattle for meat.

The black-soil belt. At the eastern edge of the Great Plains is a belt of black soil (Fig. 68-A). Through what states does it pass? Strange to say, this black soil is made by the climate, acting indirectly. There is not enough rain here for forest, but grass grows splendidly. Many grass roots rotting in the ground finally make the soil black. The vegetable matter called *humus* makes the soil easy to cultivate, lets air get into it, and makes it hold moisture. Because of the scanty amount of rain, the soil is not soaked (leached) with much water; therefore chemical substances, in-

cluding lime and other plant foods, remain in the soil. Because of this, the black soil does not lose its richness by leaching, and many of its plants gather nitrogen from the air (Fig. 97-B). Black soil is altogether one of the finest soils in the world and has been produced in all the continents where these conditions of moisture exist.

Extensive wheat growing. In the black-soil belt of central and western Kansas and lands to the south of it, in Oklahoma and Texas, and north of it in a part of Nebraska, the climate is too dry for corn, but the soil is so rich that, after first plowing this land, the farmers have been able to grow wheat year after year. Sometimes a single wheat field contains hundreds, even thousands, of acres. Recently it was found that wheat would grow in northwestern Texas on land which had been considered good only for pasture. On this rich, level, smooth black soil, one man alone, with the aid of a tractor to pull his plow and his seeding machine, can plant hundreds of acres. At harvest time he can drive a combine back and forth (Fig. 61-A) across the plain, thus harvesting, threshing, and dropping off sacks of wheat as he goes. Thus he may keep several trucks busy hauling wheat to the grain elevator at the railroad.

In June and July, after the period of harvest, the grain elevators where wheat is stored and graded are full almost to bursting. The railroad companies crowd every freight car they can upon their sidings to take the wheat away to the large storage elevators at Kansas City, St. Louis, Galveston, and New Orleans.

The extensive wheat grower, with his one crop, ten or twenty miles away from his village home, may have the bad luck of rust, grasshoppers, drought, hail, or a deluge of rain to beat down the crop. Then his failure may be complete.

Dry farming. Machinery with its large acreage per man has produced a new system of growing wheat, called "dry farming." By this system, wheat can be grown in lands that were thought to be too dry when a horse or an ox pulled the plow. The farmer who practices "dry farming" plows his land and allows it to lie idle for a whole year. No crop uses the water. Then he sows wheat the second year and uses the moisture stored the previous year.

Fig. A. The strip of Pennsylvania State College wheat at the left, with *two* shocks, got no phosphorus. The strip at the right with five shocks got 48 pounds of phosphoric acid an acre. There are now several hundred agricultural experiment stations in the world finding out such things as this.

The Columbia River Basin. The soil in this important wheat region (Fig. 63-A) is very rich. Some of it is rich, decayed lava, some is fine wind-blown dust, but can we keep it (Figs. 73-B and 200-A)?

Wheat is grown here almost precisely as it is in western Kansas.

THINGS TO DO AND THINK ABOUT

A United States wheat map. On an outline map of the United States color the winter wheat-producing area blue. (Keep this map.)

Government aid. Look at Figure 69-A and tell something about the usefulness of agricultural experiment stations and of commercial fertilizers.

Write a paragraph. Write a paragraph about wheat. In it use the following words: rotation, leaching, substance, fungi, droughts, and nitrogen.

Using the wheat tables. What does Table 9 tell you about the yield of wheat per acre in Georgia and New York? Explain this difference.

Topics for short talks. 1. How snow aids winter wheat.

2. How the scarcity of rain produces rich black soil.

3. Dry farming.

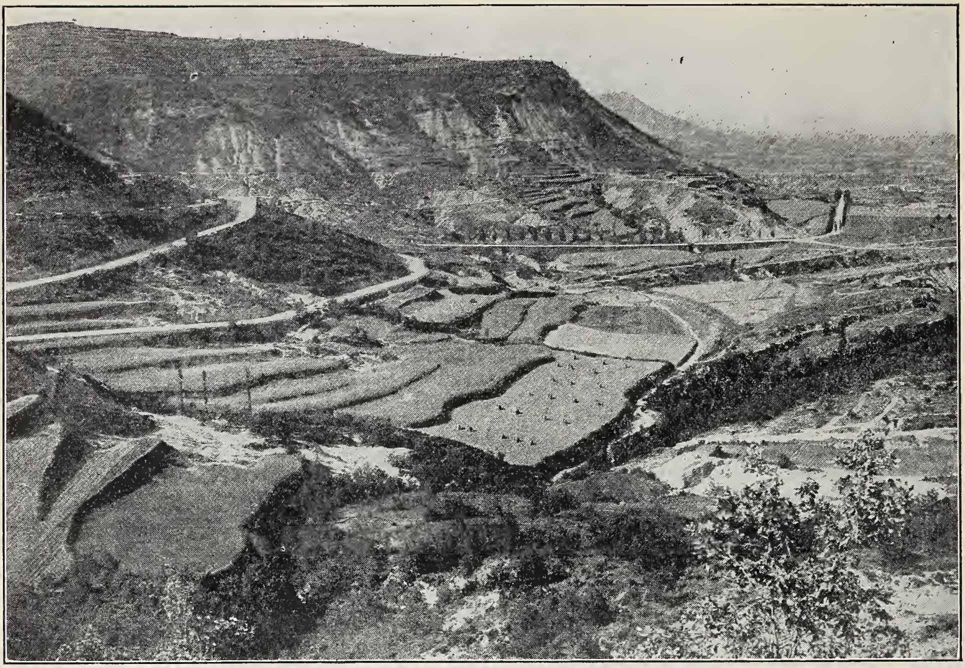


Fig. A. Grassbanks hold the earth in these terraced fields near Barcelona, Spain. Compare with Figures 73-A and 200-A. A field of wheat or some other grain has been reaped and bound into sheaves on the lower terrace.

UNIT 5—WINTER WHEAT IN OTHER LANDS OF MOIST WINTER AND MOIST SUMMER

> THINKING ABOUT LAND AND CLIMATE. Draw a map of Ireland, making changes that would give to a part of it a climate good for wheat.

II. FROM GREAT BRITAIN AND FRANCE TO SOUTHERN RUSSIA, ALSO CHINA AND JAPAN

Resemblance of regions. West Europe has a wheat region much like the one just discussed. This region is not so well suited to corn either. The southern boundary of the wheat region is a *climate line*—the lands with Mediterranean type of climate. Its northern boundary is another climatic boundary—the cold winter of the east Baltic area. On the west the boundary is where the climate becomes too wet. Therefore, little wheat is grown in Brittany (northwestern France) and western England, because rain interferes with plowing, ripening, and harvesting. Eastern England, sheltered from the rainy west winds by the central uplands, has a lighter rainfall (Fig. 23-A) and is fine wheat country. Wheat bread is a favorite foodstuff of the people, and wheat is a very important crop in France and in every country of Europe where the weather is not too cold or too wet. Ireland is too wet for wheat to be an important crop.

Cool summer of the oceanic climate. In West Europe the nearness to the Atlantic provides a cool summer, where wheat does not suffer from the heat troubles that bother it in southeastern United States. That is one reason why European countries have a large yield, but there are other reasons also. The farms are small; land is valuable; the population is dense; wages are not high. Therefore the farmer tills his land carefully, uses artificial fertilizers, plants crops in rotation, and carefully saves

manure. West Europe needs bread, and every country buys it. This helps to explain why I have often seen women walking through the wheat fields of France following the harvesters and picking up heads of wheat that had been overlooked. In Switzerland I have seen rows of schoolboys and girls walking abreast (Fig. 71-A), each carefully gleaning a small strip.

Intensive agriculture. In Figure 71-A we see the great reason that has brought millions of immigrants from Europe to the United States. They come for land. Land is the most important thing there is. In the densely peopled Spanish island of Mallorca, and also in Syria, which is very densely peopled for the amount of good land it has, I have seen wheat fields where there were stones as high as chairs and only a few inches apart, but people had dug up the earth between the stones with hoes and planted wheat by hand. Of course, they have to cut it by hand.

Hungary, Rumania, and southwestern Russia. Conditions in these countries are much like those in Nebraska, Kansas, and northwestern Texas. These countries have black soil, a hot summer, light rainfall, and uncertain weather, perhaps drought. Therefore a fine crop may be followed the next year by a poor crop.

The chief difference between this region and the extensive Nebraska-Texas wheat-growing region is in the size of the farms. In Kansas the farms average over 280 acres. The Rumanian farms average only 44 acres of arable land. The European farmer is, therefore, often unable to afford the best machinery. The Russian plan is to have one machine harvest the wheat produced by many farmers.

The Danube Valley and southwestern Russia have been a great wheat-exporting region. For several decades tramp steamers have loaded wheat in the lower Danube, at Odessa, at Rostov at the mouth of the Don, and discharged their cargoes at any of a hundred ports west and northwest of Istanbul.

Fig. A. Swiss boys and girls going back and forth across a wheat field picking up stray heads of grain.

China. China has a very important winter-wheat region in the eastern plain. The southern boundary of this region is climatic, like that of the wheat region of eastern United States. In much of this territory millions of industrious Chinese farmers will have half or more than half of their small farms in wheat or barley—mostly wheat. They cut the grain in May or June and plant the land to a summer crop of corn, soy beans, millet, sweet potatoes (page 125), or rice if the land is low enough (page 92). In autumn the land is planted to wheat again.

On many of these small farms every bit of the work, even plowing, is done by human muscle, or at best with the aid of a *cow* to pull the plow and cart. Most of the grain is threshed by hand (Fig. 61-A).

Japan. In southern Japan, wheat is grown under conditions similar to those in China.

THINGS TO DO AND QUESTIONS TO ANSWER

Do you remember? 1. What three places in Europe are like Nebraska, Kansas, and northwestern Texas? How are they alike?

2. What is the average acreage of a farm in Rumania? in Kansas? What effect does the size of farms have on the methods used in farming?

3. What reasons can you give for the production of wheat in western Europe? for the yield?

Map work. Locate the wheat-growing area of China on a map in your book. Now show this area on your world-outline map.

Some things to explain. 1. The difference in yield (Appendix) of wheat per acre in Rumania, Kansas, England, and Belgium. 2. Black soil.

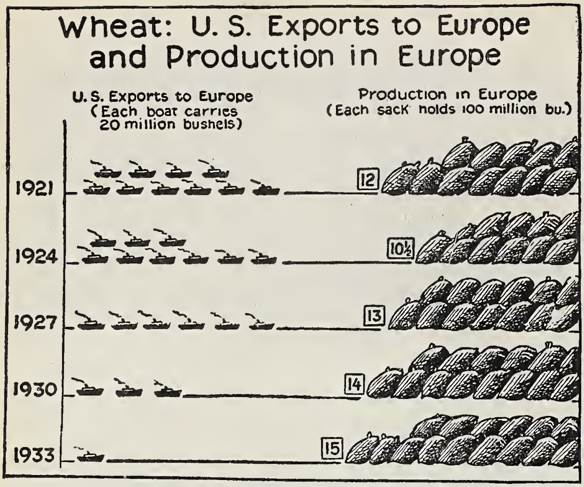


Fig. A. When Europe produces more wheat for herself, she buys less from the United States. That is the feature of the world wheat problem that this chart shows. For instance, in 1921, when many wheat ships were busy carrying the bread grain to Europe, that continent produced only 1,200,000,000 bushels. Since 1927, European countries have been producing more and more of their own wheat and the wheat traffic across the Atlantic has slowed up. In fact, efforts of European countries to supply their needs, and their buying wheat from other countries, have just about cut off our wheat exports, as the lone boat for 1933 represented in the chart indicates.

UNIT 6—WINTER WHEAT IN STILL MORE LANDS OF MOIST WINTER AND MOIST SUMMER

A Study Journey. An Australian wheat grower goes to a foreign land or lands to learn more about his business. Where would you advise him to go and why?

III. The Southern Hemisphere

Argentina. We know (page 34) that Argentina, like Kansas, has bands of climate. Notice the bands of climate by crop areas of corn (Fig. 87-A), wheat (Fig. 63-A), and pasture ranges (Fig. 2-A). See how neatly the Argentine wheat region fits in between climate on the one side that is too wet for wheat, and climate on the other side that is too dry for it.

In this wheat region which is so much like Kansas, people of European races are growing the wheat and using American machinery as in Kansas. Some of the work is done by laborers who each year, after the Italian harvests, migrate from Italy to the Southern Hemisphere, where the wheat is ready to be cut in November. In much the same way people migrate from American cities to harvest wheat in our Wheat Belt. Sometimes they begin in Texas in June and finish in Canada in September.

Compare the Argentine wheat region with that of Kansas as to distance from the sea. What ports export the Argentine wheat?

South Africa. Does South Africa have the type of climate suitable for growing wheat (Fig. 2-A)? Some winter wheat is grown in this small climatic region of Africa, but not enough for export.

New South Wales and Victoria. We have found (page 67) that Australia has a zone whose climate is like that of California and Palestine. But in inner New South Wales is a zone like Kansas or south Russia. A visitor to the wheat fields of Kansas and of New South Wales could scarcely see a difference in the appearance of the country, the wheat, the machinery, or the workers, but he would find few places in Australia or Argentina to store wheat. Therefore the farmers rush it to market as soon as it is ready.

Bands of climate. Make sketch maps and put on them the bands of climate that you would find in going from:

1. Buenos Aires to the Andes Mountains.
2. Capetown to the Orange River.
3. Sydney to the center of Australia.
4. St. Louis to the Rocky Mountains.

THINGS TO DO AND QUESTIONS TO ANSWER

Map study. What factors do you find on Figures 2-A, 22-A, and 23-A that make South Africa a land poorly suited to wheat raising?

Prove or disprove. Examine Table 9 on page 356 and prove or disprove something that is said about Argentina.

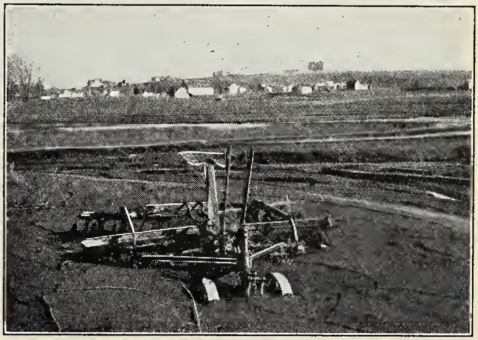
UNIT 7—SPRING WHEAT AND GLUTTED MARKETS

PROBLEM. Tell some of the troubles that must happen when nations try to limit the export of wheat.

I. The northern wheat region of the United States and its Canadian extension. Spring wheat is a product of lands with severe winter and mild, moist summer. What is the average winter temperature of Winnipeg (page 27)? Winter is entirely too cold here for winter wheat, but fortunately the summer is not too hot for *spring wheat.* Wheat sown here in spring will grow through the period of summer rain and ripen in August and September. What is the period of greatest rainfall and of least rainfall in regions having this type of climate (Figs. 22-A, 23-A)? A dry autumn is important for harvest.

What do the figures of wheat yield for North Dakota (page 356) tell you about the certainty or uncertainty of wheat production in this region? Here in the middle of the continent, far from the sea, the weather is changeable and uncertain. The south side of the spring-wheat region may suffer greatly from rust; the Great Plains side may suffer from drought; the forest side from frost in late summer; but the rich black soil gives great harvests when weather conditions are just right. Much of the land was settled by people who grew only wheat. The northern wheat region of the United States and the Canadian part of the same region are one of the great wheat export regions of the world. En route to distant markets wheat finds its way to the elevators of Winnipeg, Minneapolis, Fort William, Port Arthur and Duluth on Lake Superior, Milwaukee, Chicago, Buffalo, New York, Boston, Montreal, Vancouver, and Prince Rupert.

Far from markets. This land is remote from the sea. Which sea (Plate III)? To reach Atlantic ports most of the grain is carried by steamers on the Great Lakes. The freight rate by steamer is cheaper than that by railroad. If ships go through the Panama Canal, the rate is so cheap to Europe that the wheat from the western part of the Canadian plain is shipped from Vancouver and Prince Rupert.



Figs. A-B. In some places it takes a thousand years for nature to turn hard rock into an inch of soil. Sometimes a single rain removes that much on land unwisely managed. On this Columbia Basin soil near Pullman, Washington, the blue grass above the fence held the soil. What happened when the water reached the summer fallow below the fence? The lower picture shows what happened at the bottom of the hill. Erosion often ruins both the *hill* and the *valley.*

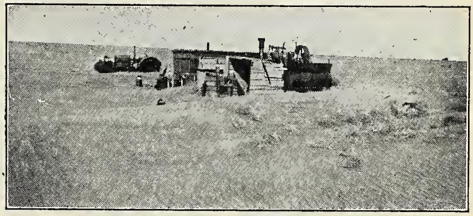


Fig. C. This cook shack on a Kansas extensive wheat farm shows the drifts of soil three feet high, well piled up by the winds of one spring. Nature had enough grass roots there to hold the earth before man killed them with his plow. In dry countries, wind erosion can be a great destroyer.

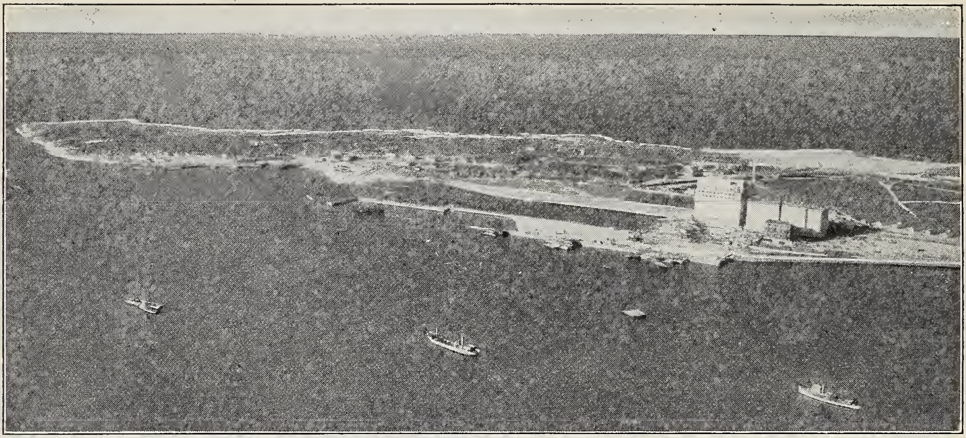


Fig. A. Breakwater, dock, and grain elevator at Churchill, on the western shore of Hudson Bay, nearer to Liverpool than is New York. Prove this by reference to a globe.

Recently a railroad was built to Churchill, on Hudson Bay, a town hundreds of miles from an important wheat field, in a place where the winter is bitterly cold. How far is Churchill from Liverpool (Fig. 329-A)? Two shipments of wheat were made in 1931 and ten in 1932. The experiment was successful, although there is no one who believes that Hudson Bay will be free from ice longer than 60 days each year, ending in early October.

The in-between belts. What states lie between our winter-wheat and spring-wheat belts (Fig. 63-A)? Here the winter is too cold to suit winter wheat or the summer is too hot for spring wheat (Figs. 26-A, 27-A). The same conditions exist in eastern Asia, where a wheatless belt separates the great winter-wheat belt south of Peiping, and a spring-wheat belt in northern Manchuria.

II. Manchoukuo (Manchuria). The great plain of Manchoukuo (Manchuria), a farm land of great promise, grew as much as 75,000,000 bushels of wheat a year during the World War, but the harvest is uncertain and the production is not so great as it formerly was because the farmers find that soy beans are a more certain crop.

III. Russia and Siberia. The same conditions that produce a spring-wheat belt in the interior of North America locate another in Eurasia—the largest wheat region in the world (Fig. 63-A). It, too, is a land of black soil; it has the climatic troubles of the spring-wheat belt of America; it is at an even greater distance from tidewater. This region probably surpasses central North America. These two are the greatest wheat-reserve areas in the world.

The glut of wheat and international agreements. Mass production of wheat (Figs. 58-A, 59-A, and 61-A) on the black-soil belts of the world has glutted wheat markets. In twenty years the world's wheat area was increased over 20 per cent; wheat production increased over 25 per cent. In the same period of time the world's population increased not more than 14 per cent. More wheat was produced than was needed; this made the price of wheat so low that the growers in all exporting countries were in distress and despair. In 1932 the nations began to limit the production of wheat by agreeing to plant fewer acres. This is an interesting plan to watch.

THINGS TO DO AND QUESTIONS TO ANSWER

For your outline maps. 1. On your outline map of the world show the route taken by a shipment of spring wheat from North America to

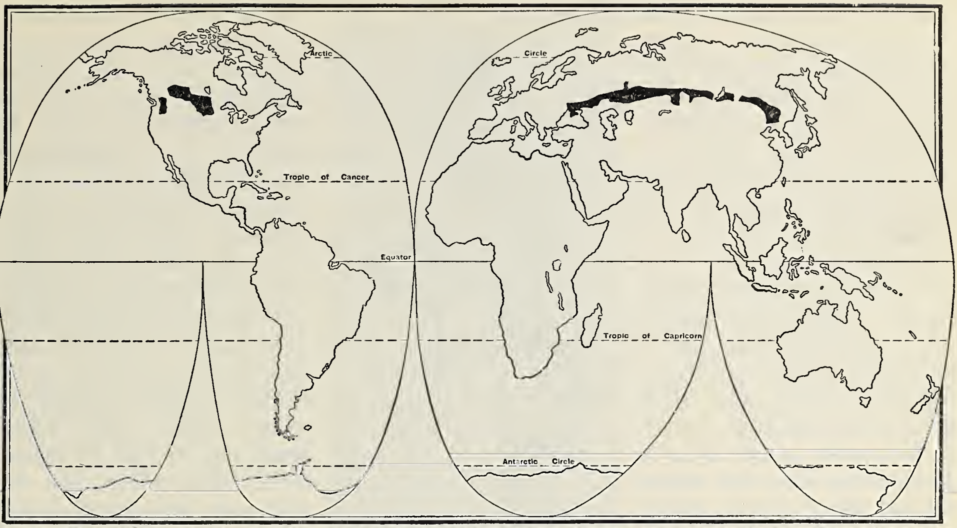


Fig. A. The solid black areas on this map have very cold winters and warm summers with enough rain for spring wheat, rye, oats, and flax for seed.

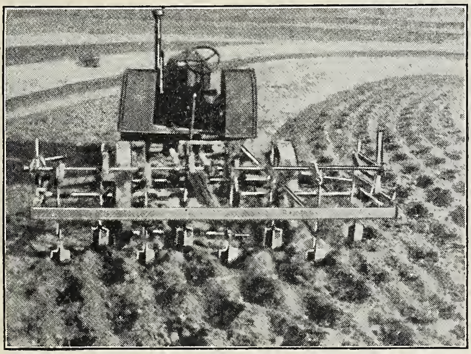


Fig. A. A water-pocket machine. Mr. R. M. Davis, of the United States Department of Agriculture, has made a great invention—a cultivator that makes many thousand small holes to the acre. They will hold a two-inch rain. Why is this valuable in dry farming?

London by four routes. Compare the distance by each route.

2. Put on your map the leading wheat export ports.

3. On your outline map of the United States color brown the spring-wheat-producing area.

Shipping wheat to England. Take a piece of string. Place one end at New York and the other end at London. How does this distance compare with the distance to Churchill on Hudson Bay? Be sure you use a globe for this exercise. Why?

Construct a graph. Show the production and yield for the selected states in Table 9.

UNIT 8—THE OTHER SMALL GRAINS —BARLEY, RYE, OATS, BUCKWHEAT, AND FLAXSEED

A BUSINESS QUESTION. As you read this, find out something about *farm management.*

Likeness of other small grains to wheat. Barley, rye, oats, and buckwheat are good food for man and for most of his domestic animals. The three last mentioned are so much like wheat that you could scarcely tell them apart. The same machinery and the same methods produce them all. Each differs from wheat somewhat in the way it fits into the farmer's work system and in the soil and climate that are best suited to it. Despite these different requirements, I once saw wheat, barley, rye, and oats growing in large fields alongside one another near Leipzig, Germany.

Barley. This is a dry-land crop. Barley can produce a crop in the drier parts of lands with the Mediterranean type of climate and along the drier edge of the Indian wheat belt. Barley is also a cold-land crop. It ripens more quickly than wheat ripens, so barley is important in Sweden, Finland, and north Russia.

Barley yields more to the acre than does wheat, so large quantities are grown for stock feed in North Europe where corn will not grow. As a substitute for corn, barley is increasing in the corn and winter-wheat belt of the United States.

Farm management. The fact that barley ripens before wheat enables the farmer to finish harvesting barley before his wheat is ready to be cut. It has also been found that because barley is harvested early, it is a better nurse crop than wheat for the young clovers, which, in nearly all countries, are sown among young small grains to be the following crop.

Rye. This is a kind of "goat" among grains. We make jokes about the goat because he can eat rougher food than any other farm animal. Rye can stand rougher conditions than wheat. It can stand more cold and will yield better on poor or sandy land. For these reasons rye is the chief grain crop on large areas of sandy soil and other soils in Germany, Poland, northern Russia, and the neighboring Baltic states.

Fig. A. Head of oats, approximately one-half size, and grains of oats. The oat grain has a chaffy husk not removed by the threshing machine. It helps the oat to stand damp weather.

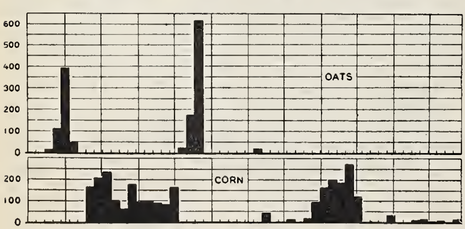


Fig. B. Distribution of hours of horse work on a 200-acre Indiana farm. Show how this graph explains the common practice of growing oats on farms in the United States Corn Belt.

Rye bread is nutritious. It is the chief food of millions of people in northern Europe, but when they can afford to do so, they shift to wheat bread. This has happened recently in Germany.

Small amounts of rye are grown in both of the more northern wheat areas of the United States and Canada, but here, too, its popularity is declining. Some of this decline is due to the development of new varieties of winter wheat which ripen more quickly and thus miss frost. This wheat can endure more drought than can varieties that were grown a few years ago.

Oats. The oat plant has four qualities that win for it an important place on thousands of farms. First, it is a very good food for horses and other live stock as well as for men. Second, oats can stand more moisture than can the grains whose heads are more compact. This fact makes oats an important crop in the damper parts of England, Ireland, Scotland, and east Canada. In Scotland oats was for hundreds of years the chief breadstuff of many people. Third, oats is a rival to rye and barley in its ability to ripen quickly and therefore to mature in the North. Examine the table (page 356) and find the relative importance of the different grains in Italy, Rumania, Germany, Denmark, and Norway.

The fourth quality that makes oats a favorite crop is the fact that in the American Corn Belt spring-sown oats ripen after winter wheat and after the corn cultivation is finished. Therefore a farmer can have a field of wheat, barley, and oats, and with

the same machinery he can harvest the three crops in different weeks. This might be called a farm-management reason for growing oats; it is an important reason in the Corn Belt of the United States, where the farmer spends March and early April preparing the ground and planting oats; April and early May getting the ground ready for corn and planting that crop; late May and early June plowing corn; mid-June harvesting barley; late June and early July harvesting wheat; early July to mid-July harvesting oats; later July harvesting hay (Fig. 76-B).

Oats are commonly a spring grain even in winter-wheat territories, but oats can be a winter grain in southern United States, where they might easily become much more important than they now are if there were a greater demand for grain in the world.

Buckwheat. This grain is not increasing in popularity; indeed, it is decreasing, but it has two qualities that give it a place among crops. One is its short season of growth, which permits the seed to be planted in mid-summer in Ohio or Pennsylvania and still ripen before frost. For this reason buckwheat can grow in mountainous and northern locations where the season is very short. Another reason for the popularity of buckwheat is that the plant is a greedy feeder, gets the last bit of fertility out of the earth, and therefore can produce a crop on poorer land than can other grains.

Fig. A. Flax has an oily seed and a stalk containing good fiber. Flax grown for seed is handled in every way like wheat. It is a favorite crop on newly broken black-soil lands. For forty years the chief export supply has come from Argentina and the spring-wheat belt of North America. By the selection of seeds of desired type we have the short, many-seeded, and the tall, fibrous-stalked, few seeded varieties. Flaxseed (linseed) oil is used for paint, and the remaining cake is a choice stock food.

Flax. See Figure 77-A.

THINGS TO DO AND QUESTIONS TO ANSWER

Planting and harvesting. If you were a farmer in the Corn Belt what would you plant or harvest at various times of the year? Fill out both columns for the year.

March and early April	

Graphs. In the Appendix are statistics which show the average annual production by countries of grain and potatoes. Make a bar graph, similar to Figure 20-A, showing the average annual production of oats in five leading countries; barley; rye.

Do you know? 1. Why barley is grown in northern Europe? What this tells about the climate?

2. Why rye is grown in northern Europe?

3. Why the people of western Europe eat rye bread?

4. The four qualities of oats that make it an important factor on the farm?

5. What crops can be harvested with the same machinery that is used for wheat?

6. What state is the biggest producer of rye? oats? barley? wheat?

7. What two good qualities buckwheat possesses?

CHAPTER SUMMARY

Extra credit for those who like to think. 1. What Figure 71-A tells about Europe.

2. What crops follow wheat in China and in eastern United States.

3. Why the low wheat yield of India.

4. Why one part of England grows more wheat than another.

5. Why wheat is grown in several types of climate.

6. Why some countries produce more per acre than others.

Maps. Complete your outline map of the world so that it will show the leading wheat-producing areas of the world. Mark spring wheat in a different manner.

By Thomas R. and Newlin R. Smith

Fig. A. This Northern Hemisphere weather map shows that the summer weather of many countries is made, like our own, by the movement of "highs" and "lows." Find the low in the Great Lake region of United States. Find the path it has traveled. Do the same for the lows in (a) Labrador; (b) the North Sea; (c) Russia; (d) Manchuria; (e) India; (f) South China Sea. Note the arrows showing wind direction near each one. ¶ The storm that went from the Yangtze to Manchuria gave rain at Tientsin, Peiping, and Mukden. If its path had been farther east, it would not have brought rain to these places. So few of these summer rain makers pass near Peiping that people near that city and west of it sometimes have crop failure, famine, and starvation.

We should know. 1. How Ireland and Rumania compare as grain-producing countries.

2. What is meant by glutted markets and what the United States Government tried to do about it in 1933.

3. How the wheat-growing region of Argentina is like that of Kansas?

4. How Kansas and New South Wales compare as to climate and methods of growing wheat.

5. When they plant wheat in India; harvest it.

6. India grows more wheat than Canada yet she exports less. Can you tell why?

7. What prospects Churchill has as a wheat exporter.

8. How the list of grains grown in Finland and Hungary tells you about the climate of these two countries.

9. How the list of grains raised in New Zealand and the per capita production tells you about the character of New Zealand as a country for growing grass.

Fig. A. The corn cultivator plows up some weeds, covers up others, and loosens up the soil ready to wash away at the next rain. Should a man be allowed to do this on hilly land and ruin it with a few crops (Figure 73-A)? Was this picture taken on a still or breezy day?

CHAPTER VI

CORN AND ITS COUSINS, THE MILLETS AND SORGHUMS

UNIT 1—CORN AND ITS CLIMATE

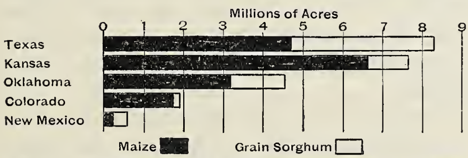


Fig. B. Leading states in the production of maize (corn) and grain sorghum.

> Understanding Cyclones. Make a map of the United States with chalk on a floor or with blue pencil on a large sheet of paper laid on the floor. Cut some arrows from paper. Place the arrows on the map in such a way as to show cyclones with centers at western Oklahoma; eastern Arkansas; Norfolk, Virginia; Boston, Massachusetts. Tell about the weather.

An American grain. The Indians gave presents of maize to the first European explorers of North America. The explorers named this new food *Indian corn* (grain). Since the Indians had neither wheat, barley, oats, rye, nor buckwheat, it was fortunate that they had corn. Corn yields more to the acre than any of the small grains. Like them, it is good food for men and many animals. Doubtless the Indians had corn for a long time, for the plant has been so changed from its wild parent that we are not sure what plant that parent was. Some botanists believe that corn is a hybrid, coming from more than one plant. When America was discovered, there were many varieties of corn growing on the patch farms of the semi-nomadic Indians. Maize was a staple of Indian diet from Massachusetts to the Gulf of Mexico, from Dakota and Nebraska, to Arizona.

The Indians of New Mexico and Arizona, who lived in stone villages, grew corn by irrigation. Corn was then, as it is now, a great crop and the chief food of the Indians in Mexico, the uplands of Central America, and the Andean countries of South America. These countries might be called "Tortilla (Corn Cake) Land."

Corn climate. The corn plant needs four to five months of warm, moist weather. It needs warm nights as well as warm days.

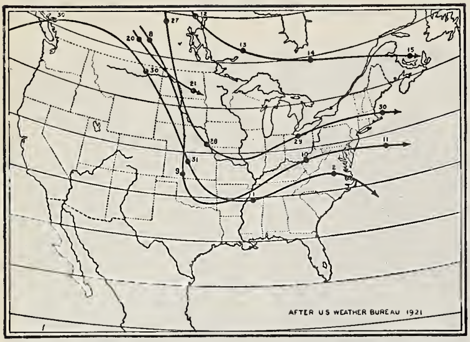


Fig. A. Paths of five highs or cool waves during one month. The dots show centers at 8 A.M., Washington time. Figures give dates.

Some varieties will mature in ninety days but little corn is grown where the growing season (Fig. 85-A) is less than 140 days. Even a touch of frost kills corn.

Corn is being grown farther and farther north because it can be cut *before it has fully ripened*, chopped—ears, stalks, and all—and stored in silos. *Silage* is good food for cattle and sheep. It will keep in the silo for a year or more.

In the Corn Belt of the United States, July is the vital month for corn, because in that month the plant often grows in height from two feet to six, seven, eight, or even ten feet. Then it blossoms, throws out the husk, and starts to make seed (the ear of corn). To supply food for this great burst of growth, the plant must have a soil rich in plant food and plenty of moisture to dissolve that food.

The long, moist summer in which corn does best can be found in several climatic regions (Fig. 2-A); in the equatorial forests, the better-watered tropic grasslands, the warm tropic uplands, and in the three areas (numbered 11, 13, and 14) that are found on the eastern sides of continents.

The corn and winter-wheat belt of the United States is the best of all the large corn regions. The fertile soil and a dependable rainfall are most important in producing a crop. To understand what corn requires, we need to know something about American weather.

Storms and rain. Look at Figure 22-A. What change in the rainfall in the United States happens near the 100th meridian? To understand this difference in the rainfall, we need to know about the storms which bring most of the rainfall in this part of the world.

The path of the cyclonic storms. Storms travel. Storms operate according to rules. Most storms that start in the same locality follow the same path. A storm may start anywhere between the Gulf of Mexico and Alberta (Figs. 81-A and 83-B). Many storms come in from the Pacific Ocean. No matter where they start, storms (or rain areas) in the United States usually travel from the west, work toward the east, and pass off to the northeast. Therefore, we might truly say that the North Central States send weather to the Eastern States.

If you should ride above one of these storm areas in an airplane, you would see the wind blowing the tops of trees in the same direction that the arrows point (Fig. 81-A). What direction is that? The wind blows toward a center. Is the twist in the direction taken by the hands of a watch?

In Figure 81-A the center of the storm is near Kansas City. The wind, blowing toward it from the south, crosses Louisiana and Mississippi and brings moist air from the Gulf of Mexico. The wind blowing toward the storm center from the southwest crosses western Texas and is, therefore, warm and much drier than the wind from the Gulf. The wind blowing toward the storm center from the northwest comes from Nebraska and Dakota. It is a cool and dry wind.

The rainfall. It so happens that the warm air blows in toward the center of this storm and then goes upward (Fig. 26-C). In rising, the air becomes cooler (page 23). Since cool air will not hold so much moisture as warm air, some of the water is squeezed out of the air and falls as rain. Look at the northwest and southeast parts of the storm

area (Fig. 81-A). What are the wind directions in each? Which part has the more water for making rain? Why? Which is warmer? Why?

The cyclone. These storms are called *cyclones* because they turn like a wheel or cycle. They seem to twist round and round as they go across the country. These storms are not the same as *tornadoes*—those terrible little twisters that are only a few hundred yards across (page 86), and which many people call cyclones. A real cyclone is several hundred miles across. One or two are crossing the United States all the time. They bring rain to the Cotton Belt, to the North Central States, and to the Northeastern States.

The movements of the storm. Figure 81-B shows the same storm the next day. See how its center has moved. It is now east of the Mississippi River.

Look at a place on the Mississippi River that had a southeast wind the first day. What wind has it the second day? Where does this wind come from? Which of these two days is cooler at this place? Eastern Kansas and Nebraska have rain the first day. They have clear weather on the second day. But the places to the south and east of the storm center are receiving winds from the sea, winds that are laden with moisture for making rain.

The third day (Fig. 81-C) the storm has passed to the St. Lawrence Valley, and the rain-bearing wind blows across southern New England and Nova Scotia, and the dry, clearing wind blows across the Great Lakes and the states to the south.

The storm crosses the ocean. Figure 81-D shows that the storm has gone out over the sea east of Newfoundland. It blows the ocean into waves that rock and roll the ships at sea.

We can trace the path (Fig. 81-D) that the cyclone has followed from the Pacific Ocean across the valleys of the Columbia, the Mississippi, and the St. Lawrence rivers, and out into the Atlantic Ocean.

These storms sometimes cross the Atlantic and pass over England and France, Germany and Russia, and on into Asia (Fig. 78-A). Meanwhile, another storm and yet another are following.

Fig. A. Cyclone center, cyclone area, and cyclone wind directions.

Fig. B. The same cyclone as that in Figure A one day later.

Fig. C. The same cyclone as that in Figure B one day later.

Fig. D. The same cyclone three days later and the path it has followed.

When a cyclone passes. When a cyclone area is approaching a certain place east of the Rocky Mountains, the wind at this place comes from the southeast and south, and the weather becomes warmer. Then the cooler air from the northern or cool side of the storm, being heavier than warm air, pushes under the warm air from the warm side of the cyclone. Then the

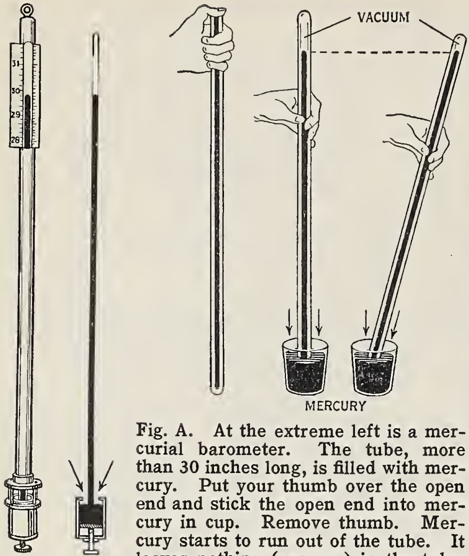


Fig. A. At the extreme left is a mercurial barometer. The tube, more than 30 inches long, is filled with mercury. Put your thumb over the open end and stick the open end into mercury in cup. Remove thumb. Mercury starts to run out of the tube. It leaves nothing (vacuum) in the tube. Air presses down on mercury in cup and pushes mercury up the tube. The amount of air pressure varies, therefore the height in the tube varies. *Light air pressure*, therefore, makes *a low barometer; heavy air pressure* a *high barometer*. A water barometer is about 30 feet high. At sea level the actual air pressure is on the average about 15 pounds (14.718) per square inch, or 30 inches on the mercurial barometer. Actually, it changes almost constantly from day to day.

warm, moist air, becoming cool as it rises, cannot hold so much moisture; therefore, the moisture falls as rain or snow.

When the cyclone has passed a place, the cold air comes in from the northwest or west, and the temperature falls still more and clearing weather soon comes. In a few days another storm (or *depression*) comes. Thus every few days in summer the needed rain comes to the cornfields of the North Central States and the cotton fields of the South. You now see why all the eastern part of North America gets abundant rains and why the ocean between New England and old England is often stormy.

The prevailing westerlies. Why do cyclones travel eastward? Because the United States is in the cool northern zone where the prevailing wind blows from the west toward the east (page 84). Naturally the cyclonic storms, which are just big eddies, twisting slowly as they go, are carried along by the more powerful stream of the prevailing wind, much as a little whirling eddy is carried along in a flowing stream of water.

Fig. B. The same cyclone as is shown in Figure 81-D and the "H," the cold wave or high area following it.

THINGS TO DO AND QUESTIONS TO ANSWER

Testing your neighbor's vocabulary. Be sure that you know the meaning of all the words in this unit so that you will not answer incorrectly. Select ten words and list them on a paper, leaving room enough to write the definition after each. Exchange papers. Who was the neighbor that was caught?

Growing corn. 1. What does your book tell you about the following needs of corn? Weather, ———. Rainfall, ———. Soil, ———. Showers, ———. Nights, ———. Growing season, ———.

2. Examine Figure 85-A and write several sentences telling what these figures tell you about the corn resources of the United States.

Making a wind map. 1. Begin your map by marking "H" for the center of one "high"; "L" for the center of a "low," and "H" for the center of another "high."

2. Draw arrows to show wind direction.

3. Draw a circle around the storm area.

Extra credit. Find out how the Indians raised and used corn. Then tell the class about it. Try to find pictures to illustrate your report.

Who am I? 1. I am the best of all large corn regions. I am ———.

2. I am a large storm area. I am ———.

3. I am the most important month for corn. I am ———.

4. I am the meridian that marks the western limit of 10- to 20-inch rainfall in the United States. I am ———.

5. I send weather to the Eastern States. I am ———.

6. I carry cyclones eastward. I am ———.

Fig. A. The same cyclone and cold wave one day later than is shown in Figure 82-B.

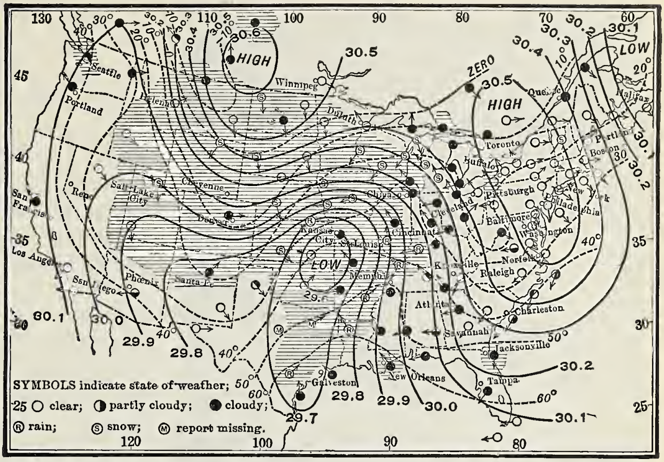


Fig. B. The United States Weather Bureau makes a map every day showing the weather at 8 A. M., Washington time. This is a winter-morning weather map, with a big cyclone (low) and a big cold wave (high) on their way across the United States. The shaded area shows where it rained the day before. The temperature (40° at Charleston) is shown by dotted lines, called *isotherms*. Solid lines, called *isobars*, show the air pressure (barometer record). Arrows show wind direction. Is it blowing out of the low and into the high?

UNIT 2—THE BAROMETER AND THE WEATHER MAP

PROBLEM. Place a second set of arrows of different color on the floor map of the United States to show the wind directions in a "high."

Air pressure and the barometer. We wonder what it is that starts the cyclone. Let us try an experiment. Light a short piece of candle and set it up in a lamp chimney or even in a paper tube. The candle heats the air. When air is heated, it becomes lighter. The cooler, heavier air around the lamp chimney pushes against the warmer, lighter air and forces it out of the top of the chimney. You can observe these movements of the air by holding a smoking piece of paper near the bottom of the lamp chimney.

Sometimes the air becomes light over a part of the earth's surface just as the air over the candle becomes light. The weight of the air is measured by an instrument called a *barometer* (Fig. 82-A).

The high barometer and the low barometer. When the barometer is high, the pressure of the air may be six or seven or even eight ounces to the square inch *more* than the average pressure. When the barometer is low, the pressure of the air may be that much *less* than the average pressure to the square inch. If the barometer in one region, let us say in Kansas, becomes low while the barometer on all sides is high, there is less pressure on the surface of Kansas than there is on the surface in Dakota or Louisiana.

In the experiment with the lamp chimney, the cool, heavier air around the lamp chimney rushed in to take the place of the warmer, lighter air. That also happens in the cyclone (Fig. 83-B). The heavy air in Dakota and Louisiana flows toward the lighter air in the center of the "low" in Kansas, and the heavy air pushes under the light air, just as it does in the lamp chimney.

Starting the cyclone. A cyclonic storm begins at an area where the air becomes lighter than the surrounding air. The heavier air rushes in from all sides and pushes up the lighter air, as the air did in the lamp-chimney experiment. The air, flowing toward this center, twists around, much as water twists when it runs out through the hole at the bottom of a basin or of a bathtub or through a round hole in the bottom of a tomato can.

Look at Figure 82-B and you will see

Fig. A. A cyclonic storm crossing the North Atlantic as it might appear to an observer many, many miles above the surface. The storm travels from west to east.

that in many different places located in this area where a cyclone makes the wind blow, wind blows from many different directions. Can you also see that, as the cyclone comes to a given place and passes by, it gives to that one place wind from many directions?

These great cyclones, several hundred miles across, with winds blowing in from all directions, are carried along toward the east by the prevailing westerly wind. How long did it take those in Figure 83-A to go 1000 miles? The scientists in the Weather Bureau at Washington often speak of a cyclone as a "low area," or "depression."

The cold wave. The cyclone, with its warm weather and its rain, is not the cause of all the rough weather we get. The cold spells, or cold waves, are responsible for part of it. Cold waves are caused by an area of heavy air or high barometer, or "high area" or "high," which is, as you know, the opposite of the cyclone, or "low." Since the weight of air in a "high" is greater than in a "low," the heavy air flows or spreads out in all directions from the high area just as water does when you pour it into the middle of a flat dish. As this air comes down from above, it contains but little water and, therefore, it brings clear weather as well as cool weather.

Figure 82-B is the same as Figure 81-B, except that we see the area having the high barometer, or covered by the cold wave, which brings clear weather to follow the period of low barometer, or warm, rainy weather. On this map the cyclone is central in Kentucky, and the cold wave is central in Montana, with a northwest wind blowing from the cool "high" or *anti cyclone* toward the warm "low," or *cyclone*.

Figure 83-A is the same as Figure 81-C, with the cold-wave area added. We see that the cyclone has gone on to the St. Lawrence Valley, and the cold wave has reached the Cotton Belt. The north wind and the northwest wind are now blowing clear and cool where two days before the weather was warm and rainy. We can truly say that the North Central States send cold weather to the Southern States in return for the warm weather that was sent north a few days earlier.

The weather procession. It is these two barometric disturbances, the "high" and the "low," that give us our weather—warm with rain when the barometer is low, and cool and clear when the barometer is high. These highs and lows follow each other across the United States in a procession that never stops, for soon after a "low" passes, or dies out, a "high" follows it. The "high" in its turn passes off to sea, or dies out, and another "low" follows. Thus, on and on, on and on they go, never stopping for hundreds and thousands and millions of years.

Look carefully at the figures showing the cyclone and you will see how important the Gulf of Mexico is to the United States. The rainfall map (Fig. 23-A) shows that when the cyclone draws south winds from the land area of Mexico, the wind does not get much moisture. Therefore western Texas

Fig. A. The length of the growing season in the United States. For how many days will plants grow out of doors in the neighborhood in which you live? Why does the map of California look so different from that of Florida?

does not get much rain, while eastern Texas does.

The thundershower. In winter the cyclones usually cause rain or snow to fall over a large area for several hours or even for a day. In the summer, however, a cyclone often gives us hot, muggy weather with sunshine most of the day but with a thundershower in the afternoon. In summer the cyclones advance eastward more slowly than in winter, because the westerly wind is weaker in summer. The air near the earth becomes very warm, because the surface of the earth is heated by the sun. The heated air expands and becomes light, so that a few cubic miles of it are pushed up in a single mass by the heavier, cooler air. This movement of the air resembles that of a piece of wood that floats in a tub when water is poured in.

As this air goes up, the pressure on it grows less, with the result that the air expands. Expanding cools it again. To see that air is cooled by expanding, let a little compressed air out of an automobile tire or bicycle tire, and notice how cool the escaping air feels. Since cool air will hold less moisture than warm air, big white clouds called *cumulus clouds* form in the heated air that rises on a summer day, just as little clouds form over the spout of the boiling teakettle (Fig. 24-B). Sometimes the water falls as rain; hence the thundershower.

The lightning of a thunderstorm is the electricity jumping between clouds or between the clouds and the earth. You can make some electric sparks by rubbing a rubber comb against woolen cloth on a cold day. Sometimes if you stroke a cat's fur in cold weather, you will see sparks of electricity and hear them snap. The sparks that you see are really very small flashes of lightning.

One big summer cyclone may cause fifty or even a hundred thunderstorms to occur in a single afternoon. The storms may be scattered over three or four states. Each

Fig. B. A funnel-shaped tornado cloud. The rapidly whirling air often causes great damage.

may be only two or three miles wide, but the storm may wet a strip many miles in length because the wind blows it forward. The storm pours down rain as it goes. Often one farm will get a soaking rain, while a farm a mile away will get only a sprinkle, and the sun may be shining on another farm but three miles distant.

The tornado. The tornado is a cyclone very small in area but blowing with terrific force. Sometimes when a thundercloud forms in the level country of the central part of the United States, it rises very quickly. The air rushing in to take its place is set whirling in a small area, as the water whirls when it goes out through the hole in the bottom of a basin. These small whirling storms are called *tornadoes*. They are the most terrible of all storms. Nothing can stop them. Sometimes they blow down farmhouses and barns, knock down rows of houses in cities, uproot big trees, and carry men, horses, and logs through the air for many yards. Fortunately these tornadoes are rarely more than a quarter of a mile wide, usually less, and extend only a mile or a very few miles. It is fortunate that tornadoes seldom occur. Of 1000 thunderstorms, probably 999 bring merely rain and cooler weather without a tornado.

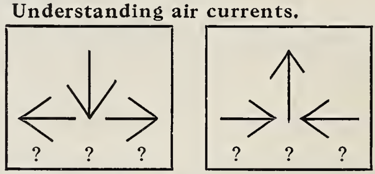
The thundershower and summer rain. The thundershowers that occur in areas of low barometer provide most of the summer rain in all of the states east of the Mississippi River. Thundershowers are very good for crops because they give frequent moisture. A thundershower is soon over; so the clouds do not long keep away the sunshine which is so necessary for plant growth.

These summer "lows" with their showers, followed by the "highs" with their breezes and sunshine, help to make the corn and winter-wheat belt of the United States the leading corn-producing region of the world.

THINGS TO DO AND QUESTIONS TO ANSWER

Use the following. Use the following words or phrases in sentences to tell something about this unit: Weather procession, thunderstorm, tornado, pressure, square inch, square foot, scientist, disturbances, and muggy.

Understanding air currents.



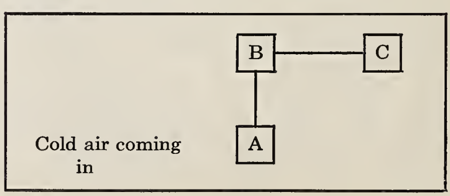
1. These figures represent air currents moving from high areas to low areas. If "H" represents a high pressure area and "L" represents a low pressure area, how would you substitute these letters for the question marks?

2. Suppose the difference in air pressure at two different places is 8 ounces a square inch. How much is that a square foot, a square yard, an acre (43,560 square feet), a square mile (640 acres)?

3. See if you can make a low area by drawing circles showing barometric pressure and putting on them the right figures for pressure and the arrows to show wind direction.

4. Draw a big July low area with its center in western Nebraska. Will it help the Corn Belt? Why?

Stages of a thundershower. Explain.



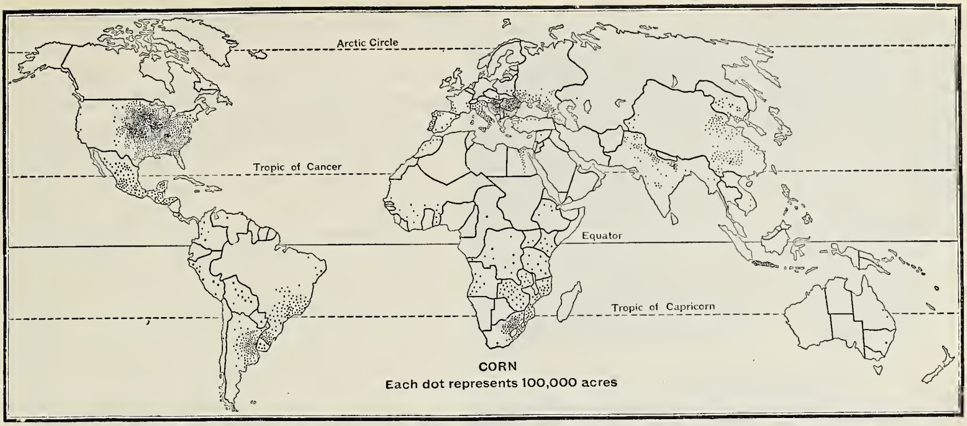


Fig. A. A world map showing acreage planted to corn. Each dot on this map represents 100,000 acres.

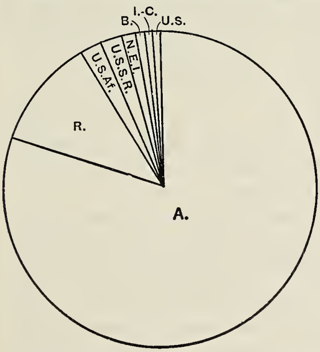
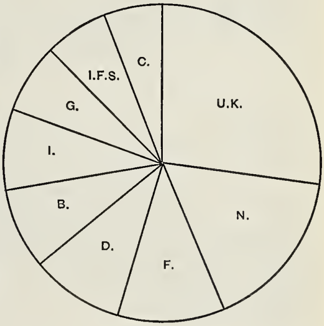


Fig. B. The graph at the left shows the leading corn-exporting countries: Argentina, Rumania, Union of South Africa, U. S. S. R., Netherlands East Indies, Bulgaria, Indo-China, and the United States.

Fig. C. The graph at the right shows the leading corn-importing countries: United Kingdom, Netherlands, France, Denmark, Belgium, Italy, Germany, Irish Free State, and Czechoslovakia.



UNIT 3—THE CORN BELT OF THE UNITED STATES AND SIMILAR BELTS IN OTHER COUNTRIES

ANOTHER WORLD REGION. On sketch or outline map of the world, color areas having climate similar to that of the United States Corn Belt.

The Corn Belt. In what *states* is corn grown (Fig. 87-A)? The yields to the acre in New England are better than in the Central States, but so much of New England is hilly and rocky that the cornfields are small. Excellent crops of corn are grown, too, on the rolling and hilly lands of New York and Pennsylvania and throughout the Appalachian region. However, the area from central Ohio to and including part of South Dakota, Nebraska, and Kansas has such a vast expanse of rich, relatively level land, where great quantities of corn are grown, that the region is called the *Corn Belt.*

Corn and meat. When you are eating beef, ham, bacon, lamb, chicken, duck, turkey, butter, cream, or are drinking milk, you are almost certainly getting, indirectly, corn in some of its many forms. Most of the corn grown in the United States is fed to the animals (page 114) on the farm or in the neighborhood where it is grown. A very small percentage goes to city markets, and still less is exported, although the grain is very popular as food for animals in western Europe.

Grain sorghums. The uncertain rainfall of the southwestern edge of the Corn Belt, namely in Oklahoma and Kansas, has caused the farmers there to turn to new crops—grain sorghums, cousins of the corn (Fig. 90-A), that have been imported from dry countries in Africa and North China.

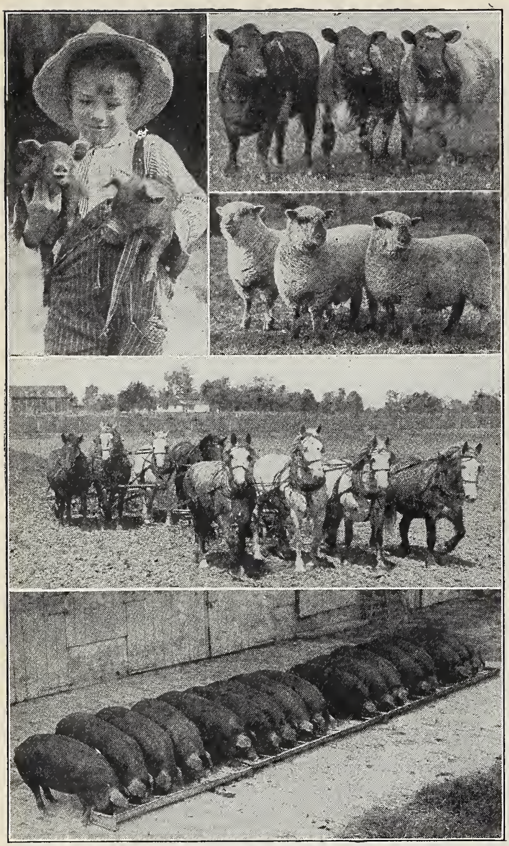


Fig. A. "Corn goes to market on the hoof." How do these pictures illustrate this statement?

These plants, often called *Kafir corn* or *milo* can stand more drought than corn can stand. They have become very important in southwestern Kansas, western Oklahoma, northwestern Texas, and in a part of New Mexico. Grain sorghums are much like corn as a crop to grow and also as food for beast or man.

The corn belt of Europe. The corn region of Europe is much smaller than that of North America. It may be compared to the western portion of our Corn Belt. The cyclones, crossing Great Britain, blow sea air, too cool for corn, far into northwestern Europe in the latitude of France and Germany. Only a little corn is grown in France. But corn is an important crop in the Danube Valley, the Balkan Mountain region (what countries?) and in a little of South Russia. In the European corn belt the farmers divide their grain lands between wheat and corn very much as do the farmers in the North American Corn Belt.

Corn in North China. Is there a region in North China which has the type of climate suited to corn and winter wheat? To the farmer in this part of the world, corn is a foreign crop. It was introduced to his land from America, just as some of the grains from China and South Africa were introduced into the United States. Some corn is now grown in most parts of the corn and winter-wheat climate section of North China. But the old stand-bys of grain sorghums are more important, because in this region, like western Kansas, the rainfall is uncertain. The people have therefore grown grain sorghums for many centuries.

Corn in the Southern Hemisphere. How many places in the Southern Hemisphere have the corn and winter-wheat type of climate (Figs. 2-A and 67-A)? Does the map explain why the Argentina crop is not usually so great as that of Illinois? The Argentine yield is uncertain because of droughts, floods, and locusts, but the black soil is of the best, and the level lands are splendid for the plow.

It suits the Argentine tenant farmer to sell his crop quickly for cash, so Argentina exports more corn than all the other countries of the world.

South Africa is one of the places where the natives grew sorghum grains as corn is grown, ate it, and fed it to live stock, long before they ever heard of a white man. The native still grows some sorghum grains, but the white man has introduced Indian corn. The climate of some sections suits the American grain well, and corn has become the chief crop for many farmers and the chief food of some of the natives. The area with sufficient rainfall for corn is not large,

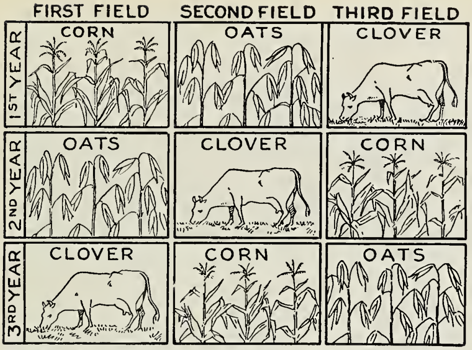


Fig. A. Three-year crop rotation on a farm in the Corn Belt. How did the farmer rotate his crops in each field from year to year?

and the total production is about the same as that of the state of Tennessee.

THINGS TO DO AND QUESTIONS TO ANSWER

The corn's relations. 1. What relatives has corn?

2. What different appearance and characteristics do these cousins possess?

3. How does their home differ from that of corn?

4. Name the sections in which these relatives are grown in our country; in other countries.

5. Locate these areas on a rainfall map. What conclusions do you draw?

6. Tell what the French farmer in Figure 90-A is doing.

What's, why's, and where's. 1. What becomes of most of the corn? Find a picture that helps you to know.

2. What factors hinder corn growing in Argentina?

3. Why does the southwestern edge of the Corn Belt produce grain sorghums?

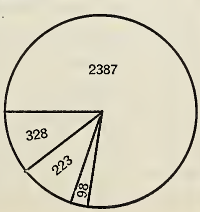
4. Why is the European corn belt smaller than ours?

5. Where is the most important corn-producing area of Europe?

6. Where have they grown sorghums for a long time?

7. Compare the location of the Chinese corn belt with the American Corn Belt.

Why are they? The accompanying circle shows the amount of corn raised in the leading countries that grow this grain. Can you name the countries? See Table, Grain and Potato Production, page 356.



UNIT 4—CORN IN THE UNITED STATES COTTON BELT AND PARTS OF THE WORLD WITH SIMILAR TYPE OF CLIMATE

> An Interesting Dialogue. Make up a suitable dialogue between corn growers from four different countries.

Cotton Belt of the United States. How many of our Southern States grow corn (Fig. 87-A)? These states have long grown cotton, fruits, and vegetables for their chief money crops, with corn second in importance. Here the soils are less fertile than in the Corn Belt. The heavy rains of winter and summer have leached them. But with the aid of legumes and fertilizers, the skilful farmer can grow large yields in these Southern States.

China. Corn grows in the part of China having this type of climate, but it is not important there because the people depend upon rice and sweet potatoes (page 125).

Corn in the Southern Hemisphere. What parts of the Southern Hemisphere have land with types of climate like those found in the United States south of the corn and winter-wheat belt?

Small quantities of corn are grown in these climatic areas in Australia and South Africa, but corn is a much more important crop in southern Brazil. There we find a type of climate we have not before met in this book—that of tropic upland coffee country (page 90). In our Southern States corn is second in importance to cotton; in the Brazilian coffee region corn is second to coffee, and all that is produced is used at home. Compare the Brazilian corn crop with that of some American states in the American Cotton Belt (see *Yearbook*, U. S. D. A.).

THINGS TO DO AND THINK ABOUT

How many areas? 1. Name the areas similar to the United States Cotton Belt which are mentioned in this chapter.

2. Locate each of these areas on a map of the world.

Fig. A. A French farmer threshing sorghum (broom corn) by hand.

UNIT 5—CORN IN LANDS WITH MEDITERRANEAN TYPE OF CLIMATE

PROBLEM. Make a profile or cross section (Fig. 30-C) showing several miles of country with Mediterranean climate where corn might be grown. Explain.

Does the Mediterranean type of climate suit corn? Corn is good food. Corn bread when hot is delicious, but as it is not generally liked when cold, it is not baked in bakeries but in homes. For these reasons corn is declining in use as a breadstuff in the United States. Being the cheapest of grains, corn is an important food where it is necessary for the people to live most cheaply. Since most peoples of the Mediterranean countries are poor, corn is an important food for them.

Some corn is grown without irrigation in the northwestern part of Spain, and in the Po Valley of northern Italy. It is grown with irrigation in many small patches of land in every Mediterranean country, but corn is also imported by these countries.

THINGS TO DO AND THINK ABOUT

Compare. Compare conditions suited to corn growing with the factors that make a Mediterranean climate.

Why is 1. Corn bread not baked in bakeries? 2. Corn a food that helps people live cheaply? 3. Corn grown in Italy and Spain?

UNIT 6—CORN IN TROPIC LANDS

SOME GEOGRAPHIC IDEAS. Make a map of a new land in the Pacific Ocean where the climate would be dry; where a river would carry much water into a desert; where corn would not do well but sorghums would.

Corn and the Indians. For the Indian populations of America, from New Mexico to southern Bolivia, corn is important as a food and as a crop, but not as an export. The big cornfield is unknown, but this important crop is grown in countless little patches of land, in lowland (Fig. 91-A), mountain valley, and warm upland.

Brazil and Ethiopia. The Brazilian upland is the only place in tropic America where corn is grown in the United States way, in long, straight rows. Unfortunately, the soil washes away badly there as it does in our own country. The Plateau of Ethiopia (Abyssinia) has climate much like that of southeastern Brazil and both corn and grain sorghums are grown there as a crop for home use by patch farmers.

The equatorial-forest garden. Recent travelers in the Congo forest found that the patch farmers were growing a good variety of American white corn in their forest clearings. Corn was introduced by missionaries and spread from village to village, from tribe to tribe.

Corn in tropic grasslands. The savannas and better grasslands of Africa are one of the old homes of the millets and grain sorghums. Just as the natives of America have grown corn since unknown antiquity, and peoples of the Mediterranean have grown wheat from unknown antiquity, so have little patches of millet and sorghum been grown by the natives of the grasslands, both north and south of the African forests. These grains are their chief food and, when the uncertain rains fail, sometimes the people starve. Good crops of grain are carefully stored. There is no export of grain from this region, and there probably never will be. The natives used to move their grain patches frequently and let the

Fig. A. A cornfield in Honduras. The seed was planted in holes made with a sharp stick in the soft earth of a new clearing. In a few years this field will be tropical jungle again.

grass grow. Now in many places the white man has taken so much of their land that they can no longer move to better land. Their fields are washing away at a terrible rate, and population is declining in these places.

Corn in India. India has a belt of savanna climate running north and south through the middle of the peninsula between the Thar Desert and the poor grasslands in the west and the eastern lands of heavier rain (Fig. 23-A). Here the Indian farmer with his slow ox and awkward plow has crept back and forth across his fields for several thousand years, growing millet and sorghum. Lately he has begun to grow Indian corn. But it is not nearly so important a crop as the crops of his forefathers.

The great oases. Durra, a kind of grain sorghum, has been one of the chief foods of Egypt since the Pharaohs built the Pyramids. The desert heat does not injure its blossoms as it does those of corn. Since we began to irrigate the Imperial Valley, the hot, dry valley near the mouth of the Colorado River, durra and other grain sorghums have become acclimated there where heat injures maize. The irrigated lands of the lower Indus provide another hot oasis where grain sorghums are grown.

THINGS TO DO AND THINK ABOUT

What does it tell? 1. What does this unit tell is grown: In India? in the Great Oases? from Mexico to Bolivia? in equatorial Africa? in the tropic grasslands?

2. Why is each grown in a certain area?

CHAPTER SUMMARY

A map. Draw or trace a map of the world and mark on it all the climatic regions in which corn grows.

A farmer's meeting. Choose five members of your class. Let each one represent one of the following places: the Corn Belt of the United States, Rumania, Ireland, Germany, and New England. Each one should prepare a class report telling why corn is grown or not grown in his country.

Graphs you can make. 1. A graph showing the production of corn in the states shown in Table 14, page 357. Make a graph for the year 1931 and one for 1920. How do the two compare? Can you explain why there is such a variation in the production of corn in Kansas?

2. A graph showing the important things about corn production from the facts in Table 8, page 356. Make one for the leading grains grown in the United States, Canada, Italy, Rumania, Argentina.

For outside investigation. Try to find how many products are made from corn.

If you like to read. Read *The Story of Corn* by Eugene Clyde Brooks.

Fig. A. Plowing rice land with a water buffalo in the Philippines. Is such land good for a variety of crops?

CHAPTER VII

RICE AND THE BEAN FAMILY

UNIT 1—RICE IN ASIA

> A Map and Profile. Show on a map a level valley, a mountain side, and a mountain stream. Put rice paddies in proper places on the map. Make a profile of this.

The Chinese farm. Wang, a Chinese farmer, his wife, daughter, and two sons were planting rice. Standing more than ankle deep in the shallow water and mud of their rice field, they backed step by step across the field as they bent down to stick the roots of tiny rice plants into the mud. The plants had been grown close together in a seed box. When the workers had finished planting the field, straight rows of young plants stuck up out of the water (Fig. 93-A). Wang's ancestors had lived on this farm in the Yangtze Valley for sixty generations. All had grown rice in precisely the same way.

The Chinese say that forty-seven hundred years ago their emperor, Shennung, made laws about planting rice. Each year with his own hands the emperor planted a little rice at the beginning of the planting season. This he did before a large audience and with much ceremony, to do honor to the most important food plant of the people, and to encourage agriculture.

Rice is supposed to be a native of the wetter parts of India. Its culture began so long ago that the plant now has several thousand varieties.

Rice climate and the paddy field. Rice needs a long, hot, damp growing season.

Since it is a swamp plant, the people of Asia long ago learned that it thrived best if grown in water.

The paddy type of rice culture has spread to all the parts of Asia that have a heavy summer rain (Figs. 23-A and 78-A). Rice is the only grain that does well in lands having frequent heavy rains.

A bowl of rice—a meal. Rice is the king of irrigated crops. For many hundreds of years the people of southeastern Asia have worked with shovel and hoes, with wheelbarrows and plows, to make the farms into little level fields, called *paddies*, with a low bank of earth around each paddy. The earth holds the water in the rice field until just before harvest when the bank is opened and the water is allowed to drain off. In the summer tens of thousands of square

Fig. A. Planting rice plants in Japan. See the mounds of earth on which two of the men are standing. How do these mounds help the young rice plants?

miles of land on the plain of the Yangtze Valley in China become a vast shallow lake divided by low banks of earth (Fig. 93-A). Here tens of millions of men, women, and children labor in the rice fields through many long, hot, humid days. Rice is grown in summer on land which is often planted to wheat or barley in winter.

The Chinese make little paddies in the valleys or on terraces on the lower slopes in the hilly country south of the Yangtze wherever they find a bit of suitable land.

Little rice is grown north of the Hwang Ho because the water supply is scanty and the soil is porous.

Long ago paddy rice culture spread to Chosen and Japan. Here many a hillside is terraced for paddies. Rice is the chief crop on millions of farms, and it is the chief food of the people. A bowl of rice often makes a meal.

Rice cannot be made into light bread. But when boiled, it is used in southeastern Asia as bread and potatoes are used in the United States.

Intensive agriculture. I have visited rice farmers in Japan who kept fish in small ponds and put them in the rice paddies to fatten. The Japanese farmer uses rice straw for rope to make roofs and even weaves it into matting to make sacks to hold grain.

Rice in India. In those parts of India where water can be had for flooding paddies, rice is as important as in China, and is grown in the same way. The great volume of water from summer floods is made to flow out through canals on to the alluvial plains of the Ganges and other rivers flowing into the Bay of Bengal. Many reservoirs in the eastern part of the Indian peninsula hold water for a time so that it may flow evenly through little canals to the rice fields.

Rice exporters. There are so many people in China, Japan, Java, India, and Ceylon that they eat more rice than they raise. Hence they import some rice from other countries.

The part of India known as Burma, and the countries between China and India—Siam and Indo-China—are not densely populated. Each has large river valleys flooded by the same monsoons that flood the rivers of China and India. What are the names of these rivers? What are some of the cities at their mouths? In summer the valleys are green with millions of acres of rice fields. In autumn and winter river boats carry rice downstream to the rice mills at the ports. There tramp steamers are loaded with rice which they take to the rice-importing countries of Asia and Europe, in much the same way that steamers carry

Fig. A. One of the many laborious ways by which the Japanese and other Orientals lift water into their rice fields.

Fig. B. Japanese woman threshing rice by the ancient comb method.

wheat from Rumania, Argentina, and Canada to populous western Europe.

Rice in the wet islands. The islands off southeastern Asia also have a heavy rainfall. Here, too, rice is important as food. On the island of Luzon, in the Philippines, a mountain people called *Igorots* have for many centuries been building and cultivating some of the most remarkable rice paddies in the world. Like steps, the paddies ascend a great mountain side. They are tended as carefully as flowers are tended in an American greenhouse.

Paddy-grown rice is the great staple food of Java and of the little island of Bali to the east. The natives of Bali, who are part Hindu, are experts in their native agriculture. There is much more rain upon the mountains at 5000 to 8000 feet in elevation than in the lowlands where rice can be grown. Therefore, the Balinese lead the rain of the mountains to places where the land and temperature are suitable for growing their beloved rice. Sometimes it goes through tunnels a mile in length.

Rice in southwestern Asia. One of the greatest luxuries for the Arab of the desert is a big dish of boiled rice to eat with his mutton. There are records that rice was grown in Iraq 400 years before Christ.

THINGS TO DO AND QUESTIONS TO ANSWER

Draw a map. Choose the best artist in your class. Have him draw a map of Asia and the East Indies on the blackboard. On it show the following: Yangtze River, Ganges River, China, Japan, Ceylon, Java, Siam, French Indo-China, Burma, and Luzon.

A trip to China. Pretend that you are riding in an airplane over the Yangtze Valley. While you are riding, write a letter to someone you know telling about the rice fields you see below you. Be sure to mention: the native home of the rice plant; why rice is called an irrigated crop; what becomes of the rice; why little machinery is used; paddies; monsoon climate; irrigation; and wet-rice land.

Give importers and exporters of rice.

Importers	Exporters
a	1
b	2
c	3
d	

Copy and enlarge these figures. After the letters write the leading rice importers. After the numbers write the leading rice exporters. Give reasons why they are importers or exporters. Compare the yield per acre in importing and exporting countries. How does it compare with wheat in this respect?

UNIT 2—RICE IN OTHER COUNTRIES

PROBLEM. Find out whether the term "a revolution in rice growing" fits this unit. Find pictures to illustrate what you say.

Upland rice. Rice does not always have to be grown in a paddy with its feet in the water, although it yields better there. Where rain is frequent, the unirrigated upland varieties of rice produce fairly well when grown as other small grains are grown. A little upland rice is grown in the rice-growing regions of Asia and in other tropic countries. The Congo natives grow it. I have seen rice growing high up on the hills of the Dominican Republic. It is common on the patch farms of other parts of the West Indies and in Central America.

Rice in Europe. The Arabs carried rice to Spain more than a thousand years ago. Small quantities are grown by irrigation in every Mediterranean country, the most important region being the Po Valley. In this valley is the largest area of level land in all the Mediterranean countries, and also the most abundant water supply, sent down from the Alps by the melting snows. A common Po Valley crop rotation is rice, wheat or oats, clover.

Rice in many tropic countries. A little rice is grown in many tropic countries, but Brazil is the largest grower outside of Asia. Brazil even exports a little rice.

Rice in the United States. As early as 1691 South Carolina had an important rice industry. The Negro slaves grew it in the same way that it was grown in China. This industry lasted for more than 200 years, but it has now almost disappeared, because of the competition of machine-grown rice.

Machine-grown rice. Rice, like wheat, is, after all, another member of the grass family. It is a small grain which can be planted, harvested, and threshed by the same machinery that is used for the wheat crop. Instead of making paddies with shovels, wheelbarrows, and backache, the

Fig. A. Javanese woman weeding a field of half-grown rice. She pushes the weeds into the mud for fertilizer.

people on the nearly level plains of Louisiana, East Texas, Arkansas, and recently in parts of the Great Valley of California, use tractors and road machines. They scoop up the earth to make banks—miles long, if need be. They prepare the land exactly as for wheat and plant the seed with wheat machinery. They lift the water with pumps driven by natural gas, gasoline, kerosene, coal, or electricity from a waterfall. They let the water drain away by gravity. When the ground is dry, they harvest and thresh the rice crops exactly as though the crops were wheat. One man with machinery can grow eighty acres of rice. In China one man can grow two acres.

THINGS TO DO AND QUESTIONS TO ANSWER

Can you find? On a map in your book find the Po Valley, Italy, Spain, and the rice-growing regions of the United States.

I am a rice grower. Choose two persons from your class. Let one be a rice grower in the United States and the other a rice grower in Asia. Each should tell the class how he grows rice. Check the stories to make sure each tells about preparing the land, cultivating, and harvesting.

Using your tables. See Tables 7 and 13 to answer the problems.

1. How does the United States compare with Italy as a rice producer? with Japan? with Brazil?
2. How do Australia and Bulgaria compare?

Comparisons. 1. Compare rice growing with growing corn or wheat as to soil erosion. Find pictures in this book that make your point clear.

2. In the table of food values (Appendix) find other foods that resemble rice in food value.

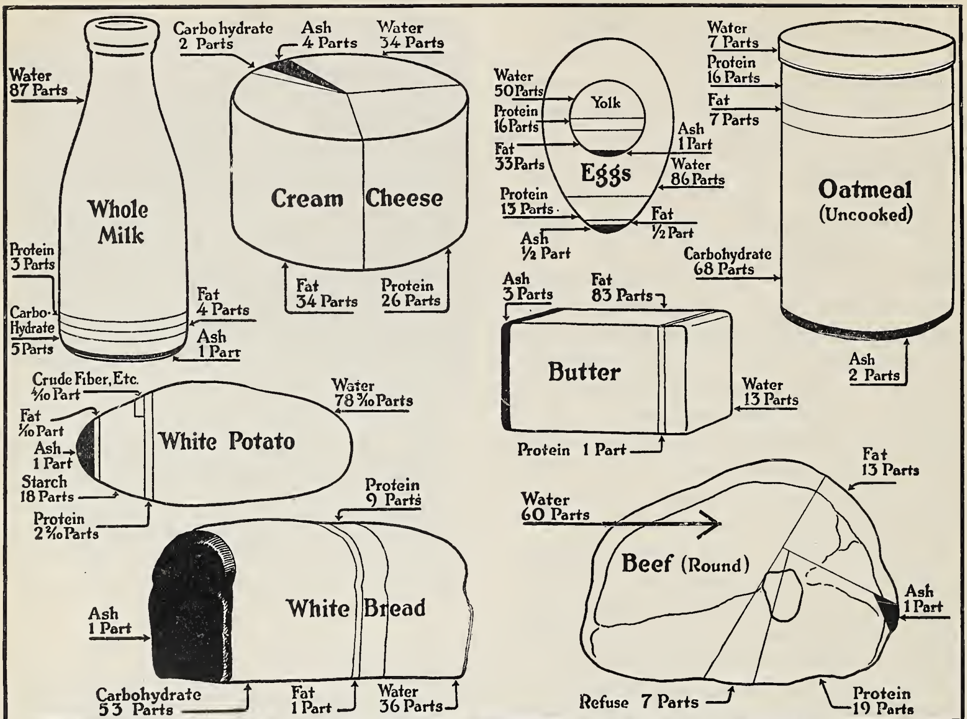


Fig. A. Charts showing the composition of foods. Why do we say that cheese is a *concentrated* food?

UNIT 3—THE BEAN FAMILY

> FIND EVIDENCE. "The density of population decides to some extent what man shall eat." Use beans to prove or disprove this statement.

Man's food. To build our bodies and repair tissue, the food we eat must contain the substance called *protein*. What foods are rich in protein (Fig. A.)? To provide energy to run this human machine, the body needs foods that have *fuel value,* usually called *carbohydrates*—mainly starch and sugar. Fat is also a fuel food. What food values do you get when you eat a sandwich of bread and butter with meat, cheese, or peanut butter?

The important beans. Some beans are good to eat while green and within six weeks after planting time. Others are best after they ripen and dry. In the dry state beans will keep for years. Beans are eaten in many more forms than wheat or rice. A recent plant explorer from the United States Department of Agriculture says the Chinese have at least 400 foods made from soy beans. Suppose you lived on a farm and ate almost nothing except what was grown on the farm. Suppose the farm were so small that you could not keep any animals but could, by much hand labor, grow several bushels of beans for each person in the family. Does the table of food values (page 373) help to prove why beans are important to that half of the human race that lives on the little farms in the monsoon lands of southeastern Asia and can get but little meat?

Soy beans. For many centuries the people of China, Japan, and Chosen have grown a kind of bean called *soy bean.* It is one of the summer crops on their crowded little garden farms. I have seen farms in Japan where the narrow banks between the paddies were so completely covered with

soy-bean plants that there was no room for your foot. As the farmer walked carefully through the paddy, pulling weeds from the rice, he also pulled weeds that appeared among the soy beans.

The Chinese and the Japanese eat soy beans as we eat other kinds of beans. Also, they crush them and get the oil. For them soy-bean oil is as butter, bacon, and cream are for us.

Soy beans are ground in water until the mass looks like milk. It has almost the same food value as milk. This soy-bean milk may be made into curd and cheese having almost the same food value as our cheese. Indeed, it is fair to say that the soy bean is a kind of oriental cow. A glass of milk is unknown to scores of millions of these bean-eating and bean-drinking people. The soy beans thrive in the dampness of the rice climate and also in the droughts of the spring-wheat climate.

Beans for export. In the last quarter of a century railroads have been built through Manchuria. Millions of Chinese have emigrated from the crowded lands farther south to the almost empty plain of Manchuria. Most of them grow soy beans for a money crop (Fig. 98-A), and the bean export has grown very rapidly to be one of the great trades of the world.

Beans in India and Palestine. In India, as in China, the farmer with his little patch of land often alternates his grain with some of the many kinds of beans, or with their cousins, the peas and lentils. These legumes furnish protein food for man, and through the nodules on their roots (Fig. 97-B) they also help to fertilize the soil for the grain crops that follow.

Agricultural scientists found out less than fifty years ago just why it is that the legumes fertilize the land for other crops, but Asiatic farmers knew of the fact long, long ago.

The *pulse* that is often mentioned in the Bible is a legume, a lentil with a food analysis much like that of beans and peas. Pulse is still grown in Palestine as extensively as in earlier times. I was greatly surprised to see in the old fields between Nazareth and Jerusalem as fine crops of wheat as ever I have seen anywhere. The explanation given was that the field was planted to wheat one year and to pulse the next year.

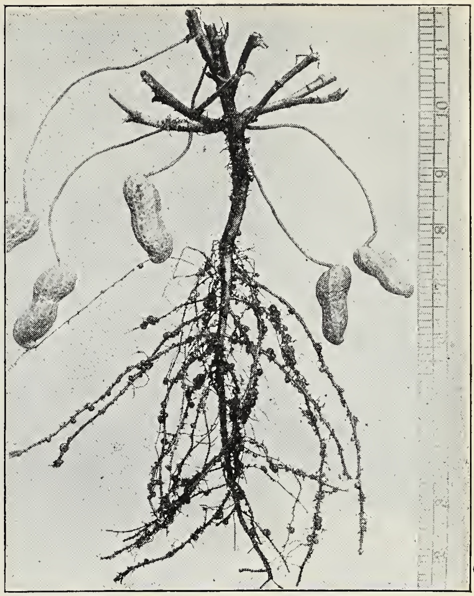


Fig. A. The peanut produces its seeds underground. They are rich in nitrogen. From what source?

Fig. B. Roots of soy beans—same seed, same soil, same field, planted same time, only fifteen feet apart. One was inoculated with the germs that produced the bacteria that made the nodules which take nitrogen from the air and supply it to the bean plant and to plants that come after it. Why are nodule-bearing plants popular in *crop rotations?*

Beans in America. The Indian farmers who make up the bulk of the population between New Mexico and Argentina are almost sure to grow patches of beans with

Fig. A. Soy beans brought in by Chinese farmers to a station on the Chinese Eastern Railway in Manchoukuo (Manchuria). What moves the carts? How old is the pattern of the cart?

their patches of corn, and they live almost entirely on corn cake and beans.

Beans are grown in almost every United States garden. The navy beans (dry or baked) that are for sale in every grocery are an important field crop in parts of New York State.

The soy bean comes. With many other crops from foreign lands, soy beans have been introduced into the United States. We make little use of them as human food. We have so many other foods and, besides, it has not been our custom to use soy beans. But millions of bushels of soy beans are now grown for food for farm animals. The crop is widely scattered through the states of the Cotton Belt and the Corn Belt and it is increasing. We might increase the crop greatly if we should need the beans.

THINGS TO DO AND QUESTIONS TO ANSWER

Important words. Make sentences using the following words to tell something about soy beans: protein, fuel value, carbohydrates, paddies, soy-bean milk, legumes, bacteria.

Short talks. Make short talks on: bean curd; bean milk; protein foods or muscle builders; carbohydrates or energy foods; bean oil; soy-bean climate; balanced diet; Indian farmers; nodules; pulse; materials for a sandwich.

Do you know? 1. How beans help rice to make a balanced diet?

2. How the soy bean is prepared for food?

3. How the growing of legumes aids in growing grain crops?

4. What use is made of soy beans in the United States? in China and Japan?

5. During what season the soy bean is grown?

CHAPTER SUMMARY

Problems for interested people. 1. If you were a farmer in the rice lands of China, what crop would you grow in the summer? in the winter?

2. Compare wheat and rice and corn in the amount of soil erosion they cause.

3. In what various ways is wheat prepared for food? rice?

4. What part do beans play in the trade of the world?

5. Examine the pictures in this chapter and in the wheat chapter and tell something about the output per man in eastern Asia (the Far East) and the United States.

6. Tell about growing rice on porous soil.

7. Would a Chinese book say "Bread is the staff of life"?

Facts from your tables. Which countries shown in your tables get the largest yields of rice per acre? which export rice? which import rice?

Extra credit: Special topics for library work and reports.

The Igorots of Luzon
Terraced hillsides for rice growing
The monsoons
Life on a Chinese farm
Balinese rice growing

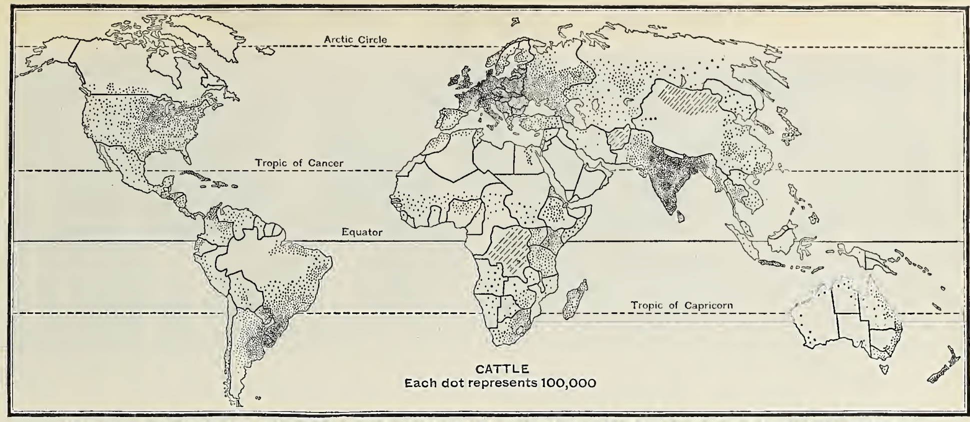


Fig. A. A world map which shows the distribution of cattle. Each dot represents 100,000 cattle.

CHAPTER VIII

THE MEAT AND EGG INDUSTRIES

UNIT 1—MEAT AND THE WORLD MARKET

A LONG JOURNEY. Make a diagram like Figure 230-A showing the stops and journeys of a beefsteak and a lamb chop from birthplace to kitchen stove. Write what happens at each step.

Good meat. Perhaps you do not like fat meat. Nevertheless, when you eat meat, you generally prefer the meat of animals that were fat, because lean meat from fat animals has a better flavor. You also like tender rather than tough meat. You like the meat of an animal that has been fattened recently because its flesh is more tender than that of one which has been fat for a long time.

Fattening meat animals. You have learned about the pastoral industry (page 30) in the grasslands that are not good enough to plow. In these great areas, found in all continents, a large part of all the animals in the world live. But only in exceptional places are the wild grasses rich and abundant enough to fatten the animals that live upon the ranges. At best these animals can be fattened only during a short season—the season of maximum rains and abundant grass. Because of this fact, the *fattening* of meat animals is a leading business of the farms in the grain-growing or alfalfa-growing sections of three continents.

The Corn-Belt farm. Take the case of a typical farm in the American Corn Belt—Ohio, Indiana, Illinois, Missouri, Iowa, southern Wisconsin, southern Minnesota, eastern Nebraska, eastern Kansas. A common arrangement of this farm would be: 40 acres in corn, 40 acres in clover pasture, 40 acres in hay, 40 acres in oats or wheat or barley. If it were a larger farm, there might be 80 acres of corn instead of 40 acres.

Three stages of intensity of farming. We use the words *intensive farming* when much labor is put on a given amount of land to make it yield a large return to the acre. This typical Corn-Belt farm shows three different stages of intensity.

1. The grain farm. The farmer may have all of his land in grain and sell grain at the near-by railroad station. If he does this, he will have little work to do for nearly half the year.

2. *The meat farm.* The farmer may have cattle or sheep which would eat the grass of his clover pasture, the hay of his hayfield, and his corn or oats. Such farming, you see, is more intensive than the grain farm, because the farmer has to grow

Fig. A. The judge will have a hard task to pick out the best animal produced by this club of agricultural high-school boys. Hundreds of agricultural high schools have such clubs as this.

crops and also to take care of animals that eat the crops. In most years he would have more income from the sale of animals that eat his crops than if he had sold the crops.

3. The dairy farm. All would agree that farming on a dairy farm is more intensive than on a meat farm, because the farmer has to grow crops, feed cows, and also *milk them.* We shall study about dairy farming in the next chapter.

Corn Belt-Meat Belt. The Corn Belt might almost as properly be called the Meat Belt, because it has so many thousands of farms where meat is the main product. It grows hundreds of millions of bushels of oats, but a very small quantity goes out of the county in which it is grown. It grows a much smaller amount of barley, very little of which is shipped out. These grain crops become the fattening food for the hundreds of trainloads of cattle that come from the grasslands to the west. They come all the way from Texas and Montana, from Arizona and Washington, and even from Mexico and Canada.

The Corn-Belt feed lot. These animals have lived upon the range until the framework of their bodies is built. Then—tall, lanky, and lean, and not very good for food—they are unloaded at the pens beside the hundreds of railroad stations in the Corn Belt. They walk out, in groups of ten, twenty, thirty, or forty, to the feed lots on the Corn-Belt farms. They spend a few months eating all they can of good grain and hay, and getting fat. From these animals comes the beef that we see hanging in the meat markets in a thousand American cities and towns.

What really happens is that in the autumn, winter, or spring, the farmer sends the crops that he grew in the preceding summer to market in the form of meat. Therefore prime fat beef can be had any day in the year instead of at only one season, as would be the case if we depended only upon the grasslands.

Perhaps a Corn-Belt farmer would rather fatten sheep or lambs than cattle. For such, there come each year trainloads of sheep and lambs from the ranges. These animals go by hundreds or thousands to the feed lots (Fig. 101-B) on the Corn-Belt farms for a few weeks of fattening.

The meat-packing plant. When the cattle and sheep are fat, they take their second and last railroad journey. The animals are not slaughtered on the farms or in the little towns because slaughtering is an industry that requires *large-scale operation.* This is true for two reasons—there can be much division of labor whereby each man does only a small part of the work and becomes an expert and speedy worker; also, in large-scale production many by-products may be made. A large packing plant such as we find at Chicago, Omaha, Kansas City, or St. Paul is really a group of factories selling several hundred products, of which about one hundred go to drug stores. In such a plant not even the scraps are wasted.

Bones are used to make buttons, and scraps of fat make soap grease. Even the blood is dried for fertilizer.

The world market for meat. The age of science and machinery has produced a series of inventions that have given us a world market for meat. After the railway and the steamship brought cheap transportation, the development of the art of canning meat made it possible for meat to be cooked in Chicago or Omaha, sealed in air-tight tin cans, and kept for a year or two, or until eaten in the homes, mining camps and lumber camps of any great forest region, or the mining camps of any desert.

Next came refrigeration. The process by which we manufacture ice is also used to cool rooms, so that, within an hour after the animal is killed, a little trolley carries its carcass into the cold room of the packing plant for thorough cooling. Then, in an iced refrigerator car, the meat is carried from the Corn Belt to any one of a thousand Eastern cities and towns or to the cold-storage plant by the docks at the seaport.

At the port it may stay a day or two or maybe three, waiting to be put into the cold chambers of the ship. Thus beef, chilled but not frozen, is taken regularly from the middle of North America to northwestern Europe and to the West Indies.

A friend of mine, dining in Oxford, England, remarked to the waiter that he was glad to taste the rare roast beef of Old England. "Thank you, sir," said the waiter. "This is American beef. It came from Chicago." He might have said that it came from Buenos Aires.

THINGS TO DO AND QUESTIONS TO ANSWER

Beef goes to market. Can you tell: 1. Why the grasslands are not suited to the raising of fat cattle?

2. In what three ways a farmer may dispose of his crops?

3. In what form most of the grain crops are usually sent to market?

4. The reasons for large-scale slaughtering of animals?

Fig. A. In winter, when the snow is deep or a hard crust has formed, sheep on the range must be fed. This central Oregon sheep herder used his tractor to haul hay to the sheep.

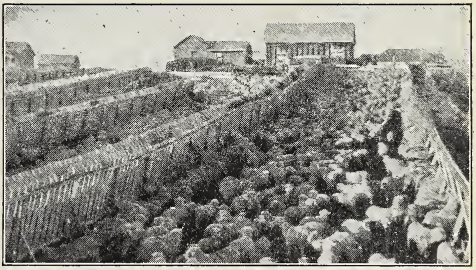


Fig. B. The long feeding racks in a feed lot in an irrigation district at the foot of the Rocky Mountains. Can you tell the rest of the story of these sheep?

5. How the tin can and refrigeration have given a world market for meat?

"King Corn" becomes beef. Give the history of a roast of beef.

Mixed sentences. 1. Animals are in the fattened sections the world throughout grain growing.

2. Meat in the form of goes to market much grain.

3. Over long distances can be transported chilled beef.

4. Leave the farm grains grown belt seldom in the corn.

5. Animals from the grasslands the Corn Belt come to of the west.

For extra credit. 1. Tell about three kinds of farms in the American Corn Belt and use the word "intensive" in connection with each. Can you also use the words "distance from market"?

2. Make a graph showing number of animals slaughtered at different cities (page 357).

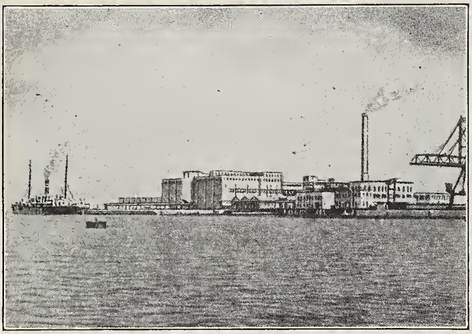


Fig. A. The meat-packing plant owned by an American firm at Rio Grande do Sul, Brazil. Find some other places in foreign countries where similar plants might find a suitable place.

UNIT 2—THE BEEF AND MUTTON INDUSTRIES OF THE SOUTHERN HEMISPHERE

> INDEPENDENCE? Tell how conditions in the Northern Hemisphere affect the meat industry of the Southern Hemisphere.

The La Plata countries. We might almost say that the American meat industry has developed a double. In the La Plata countries of South America packing plants have been built and operated on the Chicago plan by men from Chicago. For the most part, these packing plants are—like those of East St. Louis, Omaha, Kansas City, Cincinnati, St. Paul, and Fort Worth—branches of some Chicago firm.

A beef and mutton region. On the ranges of western Argentina are the same breeds of beef cattle and sheep as are on the ranges of the western United States. As in the United States, the Argentine animals go eastward by train to be fattened on corn and alfalfa, especially alfalfa, for eastern Argentina is one of the finest alfalfa countries in the world.

Argentine meat production increases. Argentine meat-packing plants, using American managers and experts, prepare meat exactly in the Chicago way. For a long time it was impossible to send the meat through the heat of the Equator except in a frozen condition. Meat that has been frozen is not so good as that which has been chilled only. Recently packers have learned how to chill beef and carry it unfrozen across the Equator to northwestern Europe. Because of the excellence of her meat and its abundance, Argentina has become the leading beef exporter of the world. At times Argentine meat is received at the docks of New York. Five of the eighteen packing plants of Argentina are in Patagonia (page 34) where lambs are fattened in the better pastures of this cool region.

Tasajo versus packing plant. Uruguay is much like the neighboring land in Argentina. It has similar meat products, with similar packing plants at Montevideo and other places on the Rio de la Plata.

The modern packing industry of this part of South America replaced the much older *tasajo* industry. For several generations the people on both sides of the Rio de la Plata had been slaughtering cattle at the dry season, cutting the meat into thin strips, and hanging it on strings, where the meat dried. Commercially the product was much like dried codfish, and kept about as well. It could be used the next year in almost any tropic place. Tasajo does not taste very good, but it is cheap and better than nothing. The new freezing and canning plants have pushed this industry up the river into Paraguay and southwestern Brazil, where the cattle from the tropic grasslands are not so good as those on the alfalfa fields of Argentina. Such cattle are also used for making beef extract, for which large plants have been built.

Modern packing plants at São Paulo and Rio de Janeiro supply much of the home market with the beef of animals that grew up on the campos of interior Brazil and were fattened on the corn of the coffee belt (page 89).

The packing industry of Australia and New Zealand. These countries show nice examples of live-stock industries neatly adjusted to the geographic conditions of different climates.

Fig. A. Katanga, Belgian Congo. Native cattle on tropic grasslands. One of the future meat reserves.

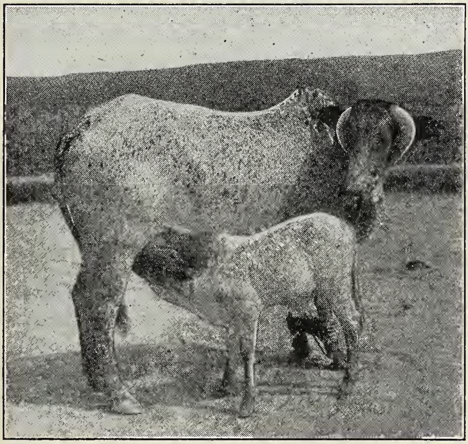


Fig. B. This humped cow, an Indian breed, often called zebu, can stand tropic climate better than the shorthorn and other European breeds that we have in the United States. Zebu is being introduced into southern United States and many hot countries. Where are some places where this breed should thrive?

In the drier parts of Australia the rainfall is light and uncertain. For a year or two the grass may be fine and the flocks may increase. Then comes a year, sometimes a longer period, when it rains but little and the sheep owner is lucky indeed if his animals do not starve. In such places he does not try to produce mutton but keeps instead flocks of the little, wrinkled sheep (Fig. 33-B) whose chief value is their fleece of fine wool.

In parts of southeastern Australia, chiefly in Victoria, where the climate is cooler and there is more rain, the sheep owner keeps mutton sheep—big, round, plump animals. They weigh twice as much as the wool-producing sheep and make excellent mutton, which is much enjoyed by millions of European families.

New Zealand has a cool, damp climate and regular rainfall much like that of Northwest Europe. Therefore it is a land of good grass. New Zealand exports much frozen mutton.

In the hot parts of tropic Australia, cattle survive better than sheep, and several points on the east coast of Queensland have meat-freezing plants from which shiploads of beef are exported to Europe. Some of the meat also goes to the Philippine Islands, Malaya, Japan, and China.

CHECK UP YOUR KNOWLEDGE

Giving reasons. Give reasons for:

1. South America being a great meat raiser; an exporter.
2. Scientific meat packing in Argentina, Uruguay, Paraguay, and Brazil.
3. Tasmania and New Zealand being well suited to raising excellent mutton.
4. Cattle being raised in Australia.

Comparing distances. Use a globe. By means of a string, compare the distances from meat-export points to London. Show the actual routes (Fig. 329-A). Through what zones do they pass?

For extra credit. 1. Use your *Yearbook of the United States Department of Agriculture* and see what you can find out about the export of mutton and other meats from Southern Hemisphere.

2. Tell something about distance, cost of ocean freight, grain export, and meat export from Australia and New Zealand.

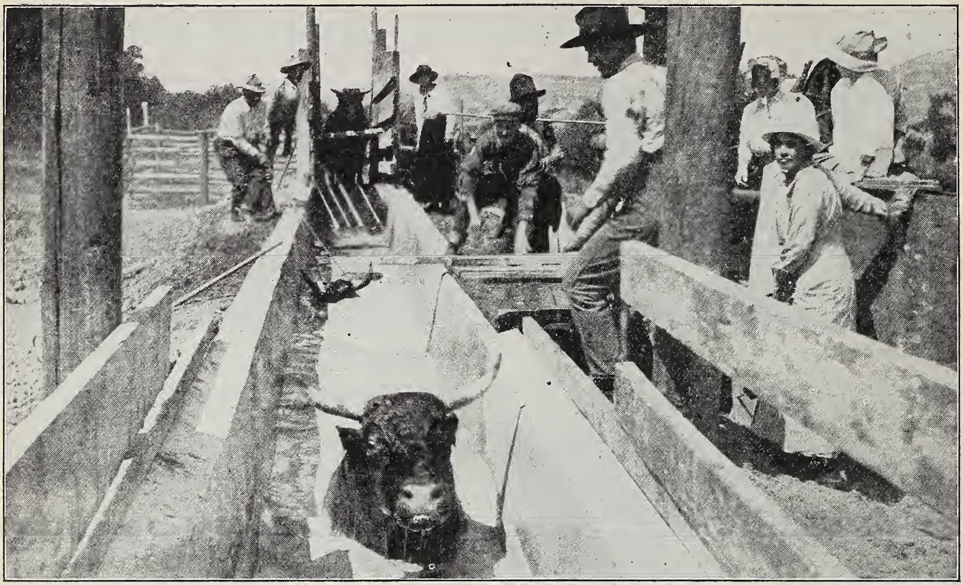


Fig. A. Dipping cattle. They are soused under strong disinfecting liquids—head, ears, horns—all soaked. This kills ticks. Ticks carry fever germs. The fever has kept good cattle out of large areas of land in southern United States and other warm countries. The dipping vat spreads the cattle industry.

UNIT 3—BEEF AND MUTTON INDUSTRIES IN EUROPE

> A MAP STORY. Make a sketch map of the world and put on it colored or shaded areas and lines and legends that will tell the story of the European meat supply.

Increasing use of meat. The people of Europe have greatly increased their use of meat in the last half century. The population has increased and the people eat more meat per person. In France meat consumption per person more than doubled in the last sixty years.

More animals per square mile. The population of Europe is denser than that of the United States. The farms are smaller. They are more intensively cultivated, and in most cases they yield more to the acre.

European meat production has greatly increased in the last half century through scientific agriculture (page 190) and because of the use of *imported feeds*. Not only does western Europe import meat but she imports also corn, cottonseed meal, linseed (flax) and other oil-seed cake or meal, wheat bran, and even hay to feed to animals on her rich farms. This is especially true of the Netherlands, Denmark, and Great Britain.

Europe has no great meat-packing centers, such as Chicago or Buenos Aires. Even though it has more animals to the square mile of farm land than does the United States, every country of Europe west of Hungary and Yugoslavia, except the Netherlands, Denmark, Poland, and Irish Free State, imports more meat than it exports.

Land use and meat. The rich pastures of the hills of Ireland, Wales, and Scotland send young animals to be fattened on lowland farms. So do the pastures of the Alps, Carpathians, Pyrenees, Balkans, Kiölens, and the French uplands.

COMPARISONS

Europe eats meat. Point out all the ways you can in which the meat industry of Europe is like that in the United States; unlike it.

Summer pasture lands. On physical maps locate many mountain-pasture areas.

Fig. A. A world map which shows the distribution of hogs. Each dot represents 100,000.

UNIT 4—SPECIALIZATION OF ANIMALS AND THE PORK SUPPLY

AN ANIMAL DIALOGUE. Make up a conversation that might occur between a pig and a goat about *food,* and about the way each animal helps man.

Specialized breeds. In the United States the breeds of cattle are sharply separated into two groups—*beef breeds* of the pastures and meat farms (Fig. 107-A) and *dairy breeds* of the dairy farms (Fig. 116-B). In Europe, outside of Great Britain, this separation exists to a much smaller extent. A much larger proportion of the European cattle are what we call *dual-purpose* (two-purpose) animals—cows that are moderately good for milk (Fig. 116-C), and when through with that service, are also moderately good for beef.

This more intensive use of land and cattle helps to explain the fact that Europe makes greater use of sausages than does the United States. European meat-shop windows display a great variety of sausages of many colors, many shapes, of many mixtures unknown in most American towns. The cow that has served five or six years in a dairy farm is a bit tough. So is the ox. But tough meat makes very good sausage. America is following in this direction, as evidenced by the increasing use of an article of food that bears the strange name of "hot dog."

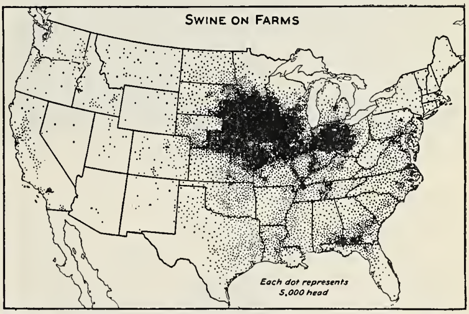


Fig. B. Point to the state in which you live. How does its production of swine compare with other states?

Different foods and different anatomy. While the camel and the goat will eat grass if they can get it, they live mainly by browsing. They will eat the leaves of almost any plant that is not too thorny or positively poisonous, and also the twigs and bark of many species. The camel and the goat are animals of the desert's edge, and camel meat from Arabia and the Sahara is the standard meat food of the Egyptian peasant. If farm produce sells well in Egypt, the camel owner of Arabia rubs his hands in glee, because he knows that his fat old camels will sell well when he takes them to Egypt.

The sheep, probably a native of the mountains in the dry part of Central Asia,

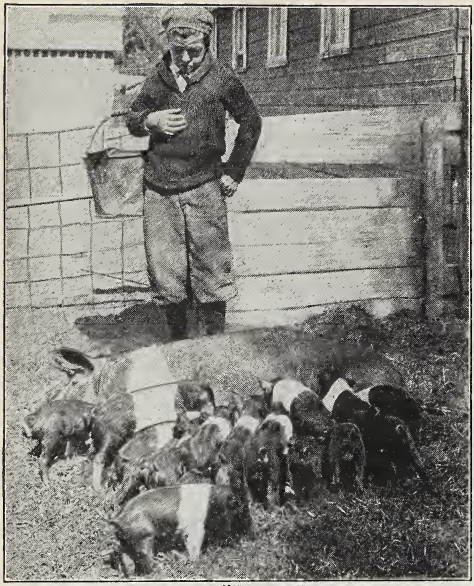


Fig. A. John Plummer, "Future Farmer of America," with his sow and litter of little pigs.

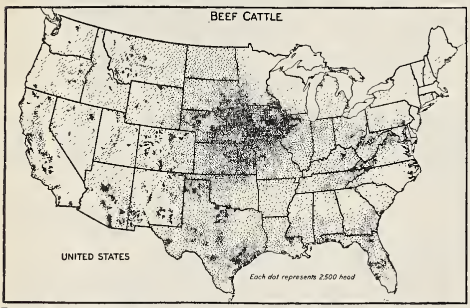


Fig. B. Notice the relatively few beef cattle in the states along the Great Lakes. The Lakes-St. Lawrence area is dairy land.

somewhat resembles the camel and the goat in its feeding habits. This is true especially of the sheep of desert regions, for, like the camel, it stores fat on its body when pasture is good, and it lives on the fat in periods of scanty food. This fat is stored, not in humps, as the fat is stored on the camel's back, but in lumps of fat near the end of the spine or, more often, in a huge, fat tail (Fig. 33-B). Many breeds of fat-tailed sheep are found all the way from Peiping to the Indus, and from the Indus to Istanbul and the Strait of Gibraltar.

The hog. Hogs are forest animals. The same species as that of our common domestic swine is found wild in the mountain forests from Chosen to Central Europe, and there are several allied species in the tropic forests of Asia, Africa, and South America.

In the forest the wild hog eats nuts, fruits, roots, and leaves. Not only does he eat any kind of digestible vegetable matter, but also any kind of digestible animal matter—grubs, worms, snakes if he can kill them, and meat of any kind. He will eat some grass if nothing else is available.

You may search in vain for a herd of swine in the pastoral plains where sheep, goats, cattle, and camels may be found in thousands; but you will find them by the million where grain is cheap.

Pork in the American Corn Belt. Corn in the upper Mississippi Valley has been, pound for pound, the cheapest grain in the world market most of the time for a century. Therefore this region has become the greatest center in the world for commercial pork production.

Thousands of American Corn-Belt meat farms send most of their produce to market in the form of live hogs rather than live cattle or live sheep. These animals usually spend the whole of their short lives on the farms where they are born. In six months a well-bred, well-fed pig weighs 200 pounds and is ready for the packing plant.

Chicago, the commercial capital of the Corn Belt, is by far the greatest slaughtering center for hogs in the entire world. The ham, bacon, lard, and other pork products from its plants are scattered widely throughout eastern North America and northwestern Europe.

Argentina. In the United States the numbers of hogs and cattle are about equal. Argentina has ten times more cattle than hogs. Cattle are much easier to rear, much less liable to disease, and much better suited to an absentee landowner. Therefore Argentina specializes in cattle.

Pork in the potato and barley belt of Europe. We have found (page 88) that

northwestern Europe, in the climate suitable for small grains and potatoes (Fig. 2–3-A) is too cool for the satisfactory growth of corn. Instead of corn, barley and oats are grown. In many countries tens of millions of bushels (page 356) of potatoes are grown and used for stock food, especially for swine. The leaders in this practice are Germany and Poland, where the combination—barley or oats and potato—makes a fair substitute for corn and permits the hog to be a very important item in the agriculture of northwestern Europe.

The bacon of Ireland and Denmark, produced by hogs of certain breeds fed in a certain way, is famed in many markets, where it brings a high price because of the uniform quality and the much desired streak of fat and streak of lean. Some Irish bacon is used in the United States.

Pork as a by-product. In those parts of the world where commercial butter making prevails, the dairy farmer who produces 100 pounds of milk sells about 3.75 to 4.50 pounds of butterfat to the butter maker. The rest of his hundred pounds remains as skimmed milk. This is high in protein, mineral salts, and vitamins, and is excellent material to build the muscles and bones of young animals, whether bipeds or quadrupeds, but especially pigs. Therefore, the dairy industry and the pig industry are found side by side in every commercial butter-exporting center of the world. This makes an important pork industry in southern Wisconsin (Fig. 106-B), southern Minnesota, parts of Dakota, and Ireland. It is growing to some extent in western Canada, and it helps to make Denmark the greatest per capita exporter of pork.

The hog as a scavenger. The ability of the pig to eat almost anything makes him useful on the small farms of China. The farm may be so small and the family so poor that a horse or a cow cannot be kept, but the family can often manage to keep a pig by feeding it weeds, potato skins, table scraps, garbage, and a little grain. When the pig is fat, it furnishes most of the family's meager supply of meat. Altogether, the scavenger pigs of China make that country, with its vast population and great number of farms, one of the leading hog-producing countries of the world.

Fig. A. By careful selection, generation after generation, men have produced very different types of cattle. This shorthorn cow is of a beef breed from England. In what other countries should they thrive?

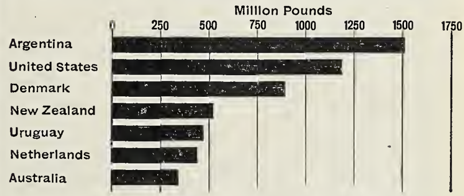


Fig. B. Value of meat and meat products from leading exporting countries.

TO TEST YOUR THINKING

Words and expressions. Use the following words in sentences telling something about this unit of work: anatomy, browsing, digestible, dairy breeds, omnivorous, beef breeds, camel, dual-purpose, desert, sausage, scavenger, fat, potatoes, butter, prodigious, forest, and by-product.

Can you do it? Choose one from your class to act as leader. Let him repeat one of the following; then call on someone to complete the sentence.

1. Europe raises cattle because ———.
2. They serve a double purpose because ———.
3. Chicago is the greatest slaughtering center for hogs because ———.
4. The dairy industry and the hog-raising industry are closely related because ———.
5. Hogs are the favorite farm animal of the Chinese because ———.

Word hunt. Put the descriptive words in columns under the proper headings.

Hog Cattle Chicago

forest — beef — snakes — grubs — China — plains — butterfat—potatoes—corn—packing plant—dairy breeds — market — milk — nuts — scavenger — slaughter

Fig. A. An egg factory. Much study and experiment have produced a very scientific type of henhouse in which hens stay for months, keep healthy and warm, and lay eggs most efficiently. Beginning at the extreme left you see roosting boards above platform, manure carriers on trolley, feed troughs, drinking fountains, nests, and straw in which the chickens scratch to get exercise (and grain).

UNIT 5—POULTRY AND EGGS

PROBLEM. What is the most widespread animal industry and why is it so widespread?

Taming wild birds. Taming birds has appealed to men in many lands for a long time. Explorers in Central Africa sometimes find pet birds owned by people who have no other form of live stock. For centuries man has tamed the hawk to hunt for him, the cormorant to fish for him, the canary to sing for him, the parrot to chatter to him, the swan to look majestic on the pond in the park or the private estate, the pheasant as game in the hunting preserve. The chicken, duck, goose, turkey, guinea fowl, and pigeon have been tamed and raised in quantity for the more practical purpose of providing meat, eggs, and feathers.

Birds that are specialists. Of the six economic fowls, only the chicken has become a great egg specialist. Other fowls are raised chiefly for their meat. The goose is raised for meat and for feathers.

The chicken is supposed to be a descendant of a wild bird known as the Himalayan hen. It is said that you can take a dozen breeds of chickens, of many sizes and colors, liberate them where they can run half wild for a few generations, and their mixed progeny will become again much like the Himalayan hen—a dark-reddish bird that hunts its living in woods and glades and, like the quail, flies short distances to escape its enemies.

The specialization of the chicken species (Figs. 109-A-B) into a hundred breeds with a great variety of qualities is an example of what man can do when he applies the newfound knowledge of heredity to the breeding of animals. The chief divisions of the chicken breeds are those that produce meat and those that produce eggs.

A by-product industry. Chickens, ducks, and geese are as omnivorous as pigs. A chicken will eat grass, snails, grasshoppers, and other insects, dig worms out of soft earth, hunt about the barn and

barnyard for the leavings of grain that has been fed to other animals. The great bulk of poultry and eggs is produced by the small flocks that shift for themselves on the farms of the United States, Europe, and Asia. These chickens, ducks, geese, turkeys, or guinea fowl run about the farm as a kind of by-product.

Most of the American poultry is to be found in the Corn Belt, the state of Iowa leading in production. Here there is a second kind of poultry business. The farmer aims to have several hundred chickens to eat some of his corn.

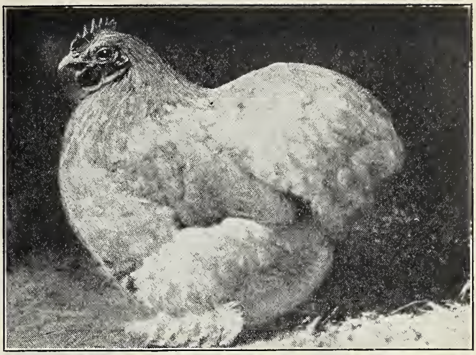
What does Figure 108-A tell about methods in the poultry industry? The industry is important, but rarely is it a large-scale industry. Only 5.27 per cent of the chickens of the United States are in flocks of 1000 or more. A little more than 13 per cent are kept in flocks of more than 400.

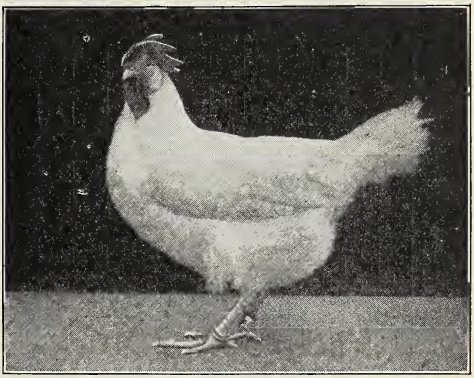
Egg-production centers. There are, however, large specialized henneries, where all the food is bought and hundreds and even thousands of hens are kept in buildings that are very carefully constructed to give light, fresh air, and protection from cold (Fig. 108-A).

There are even a few places where great poultry centers have grown up. These are usually near markets. Thousands of hens are to be found on scores of large poultry farms near Los Angeles, San Francisco, Seattle, Salt Lake City, and New York City. Shiploads of Argentine corn go to Seattle to be used on hen farms.

European poultry industry. The poultry industry of Europe is much like that of the United States, though less specialized. As in the United States, the chief export centers are in two kinds of localities. One is the corn belt—the Danube Valley, Hungary, Bulgaria, Rumania, Russia, Austria. The other is in the Netherlands and Denmark, near the great city markets.

The goose can live on grass alone more nearly than can any other poultry. In Germany and Czechoslovakia geese are often herded in pastures exactly as are





Figs. A-B. The big, heavy (11 lb.), lazy meat breed, buff cochin, which lays few eggs and the small ($3\frac{1}{2}$-4 lb.), industrious leghorn which lays many eggs.

flocks of sheep. All the geese of a village often go out in one flock and at evening return, each turning into its own dooryard. Coöperative associations have done much to improve the industry in Austria and Denmark.

Chinese poultry. In China their scavenger habits make poultry important in the economy of the small farm. In the 10,000 miles or more of canals that thread the rice lands of the Chinese plain, ducks and geese catch water insects, and dive and work over the mud of the canal bottoms to find slugs, bugs, and edible water plants. China is one of the important egg exporters of the world. Many of the eggs are sold in the dried form.

The widely scattered hens. I have seen chickens riding with the Bedouin Arabs as they shifted their camps in the

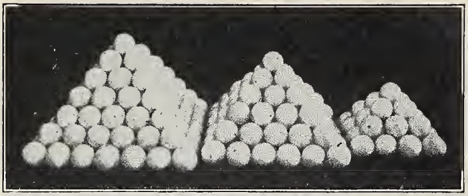


Fig. A. Can you count the number of eggs in each pile? They show the results of a feeding experiment at the Ames, Iowa, Experiment Station.

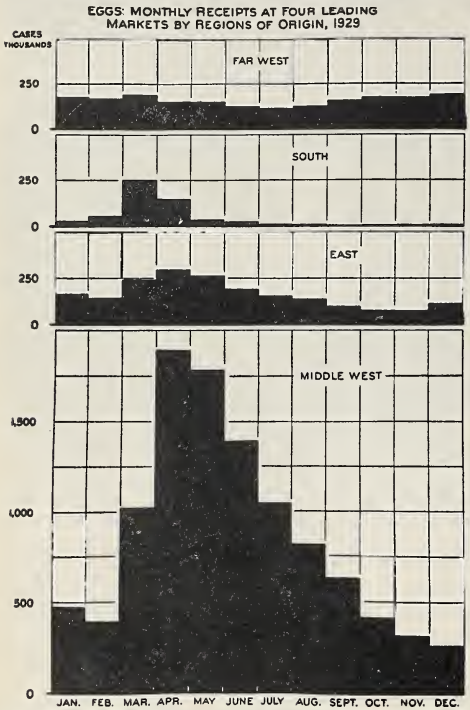


Fig. B. Monthly receipts of eggs at four leading markets. How does this graph show (1) the importance of cold storage which keeps eggs for several months? (2) a resemblance between the egg business and the meat business?

edge of the Sahara. I have seen chickens scratching around the grass houses of the patch farmers in the tropic forests on trade-wind shores of the West Indies, East Indies, and Central America. Hens are to be found in almost every village of Europe, Asia, and Africa. Some form of poultry for home use is kept more widely than any other live stock.

An important and advancing industry. Cold storage and swift transport have improved marketing conditions and increased the use of eggs in the United States from 109 a person in 1879 to 263 in 1929. We have not yet reached the recommended egg each day for each person, but the poultry industry already leads all farm produce, except dairy products and hogs.

The hen is being rapidly improved as an egg producer. Egg-laying contests have become common. In 1921 the average annual production was 160 eggs for each hen; ten years later it was 213.

Mass production. More than half of the chicks in the United States are now hatched in commercial hatcheries in machines holding thousands of eggs. The eggs for hatching are usually laid by pedigreed hens whose egg record is known to be high, and the young chicks to the number of nearly three hundred million are shipped out each year to the farmers who rear them.

THINGS TO DO AND THINK ABOUT

What's and why's. 1. Make a list of the wild birds that man has tamed. Why has man tamed each?

2. Why is Iowa the leading poultry producer?

3. Why is the poultry industry rarely a large-scale industry?

4. Why are chickens so widely raised?

5. What do the ducks and geese of China eat?

Extra credit. Who will make the best list of words which, if used in sentences, will show that you understand the important facts in this unit?

CHAPTER SUMMARY

Raising our meat supply. Make a chart that will show the principal foods of all the animals named in this chapter.

Make a talk about: 1. Science and the food supply, using pictures in this chapter.

2. By-products of the packing industry.

3. A farm that might be called a factory.

4. England has many large estates. Denmark has no large estates and many small farms. How does this affect the agriculture of the two countries?

Special work for interested people. Explain:

1. Why New Zealand and Australia are adapted to sheep raising.

2. Why the Corn Belt is adapted to hog raising.

3. Why Denmark specializes in meat and poultry.

4. Make a graph comparing the exports of the meat-exporting countries of Europe.

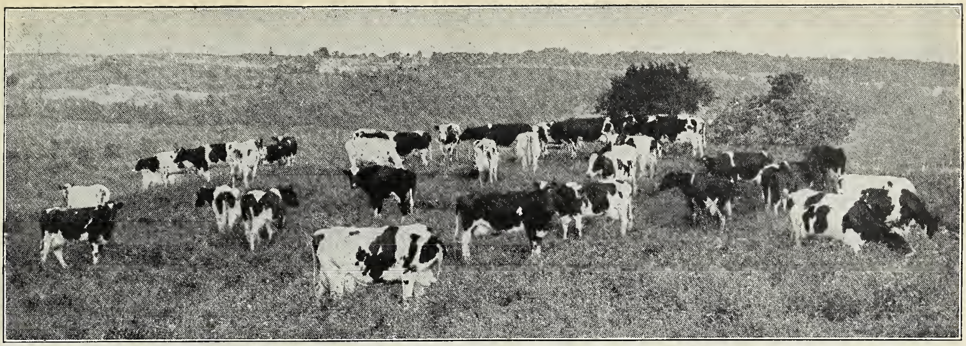


Fig. A. Pure-bred Holstein-Friesian cattle grazing on a farm in New York State. Wisconsin and New York lead all other states in value of dairy products.

CHAPTER IX

DAIRY PRODUCTS

UNIT 1—MILK AND THE DAIRY INDUSTRY IN NORTH AMERICA

Some Locations. Let someone point out fifteen places in many different parts of the world. Let each of the class make a correct list of milk animals that would be at home in each place.

Milk. Milk is the natural food for the young of that very large class of animals called *mammals*. Even the seal and the whale are mammals. Man has taken milk for his own use from various animals, chiefly from the cow, goat, camel, mare, sheep, reindeer, and Asiatic buffalo. Only one of these animals produces milk in large quantities for commercial markets, but each of the others is of great importance to some group or groups of farmers or nomads.

Milk of the camel and mare. Many camel nomads of the Sahara-Arabia region use camel's milk. This milk probably reaches its greatest degree of importance to a people in that little-known land called the *Empty Quarter of Arabia*. Very little water is to be had there. What is found is so salty that man cannot drink it, nor can any domestic animal, save the camel. Men who go to the Empty Quarter for a season have only the milk of their camels to drink.

Mare's milk is a great stand-by of the horse nomads of Mongolia and Central Asia. It is said to be nourishing and also very refreshing.

Milk from sheep, goats, and reindeer. Sheep and goats are the chief property of the camel nomads of Mongolia, Central Asia, the plateau of Iran, Arabia, and the northern edge of the Sahara. The nomads travel on camels, horses, or donkeys, but most of them make their chief living from sheep and goats.

This pair—the sheep and the goat—like the camel, can produce milk while living on harsher and drier herbage than that of the cow. Therefore sheep and goats have long been important producers of milk as well as meat in the Mediterranean region, where the summers are dry and the pasture is poor.

One day, while riding through a Portuguese estate, I came upon two men with a pen of several hundred sheep whose lambs had been taken away. The men were milking the sheep. The milk was to be made into cheese for winter food for the people.

The Greeks have a breed of sheep which, in addition to the usual product of wool and mutton, is especially famed for its heavy yield of milk.

The goat is used for milk much more than is the sheep. Everywhere in the Mediterranean region it is a common sight to see a

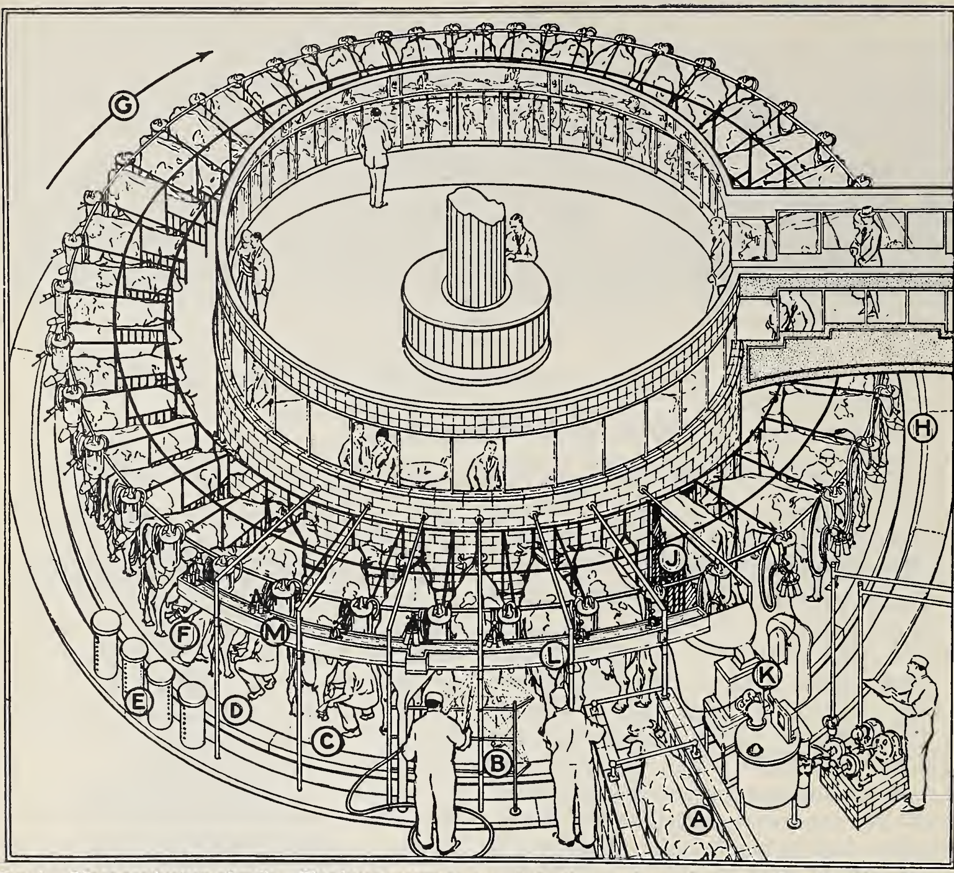


Fig. A. Mass production of milk. This huge merry-go-round of a thousand-cow dairy near Trenton, New Jersey, lets 39 men do work that had been done by 110 in the old hand way. The diagram above shows how the system works.

(A) The cows step onto the moving platform.
(B) The cows are washed almost automatically.
(C) Each cow's udder is wiped off with two individual sterilized towels.
(D) Milk samples from each quarter of the cow's udder examined by drawing it on a fine-mesh copper strainer.
(E) The milking machines are attached to the cow.
(F) The platform moves 15 feet a minute in direction "G" and completes a revolution in 12½ minutes. By this time the cow has been milked and you can see her stepping off the platform to go back to her living quarters.
(K) The milk is automatically dumped from the Pyrex jars (J), weighed, and piped to the bottling room.

The milking machine is thoroughly rinsed in cold water and then sterilized by hot water before being used on another cow.

Note observation room for visitors, shut off by glass from milking room.

The users of this machine say that all cows should be kept in thousand-cow herds and milked this way.

herd of goats walking through the streets of a town. If a woman wants to buy milk, she brings out a pail or bottle, and the goat is milked in front of her door. The goat-herd milkman then drives his living milk carts on down the street until he meets another customer who has heard the tinkling of the goat bells.

The goat will give more milk in proportion to her weight or her food than the cow. But the goat's milking period is usually short, and she is too small to bother with where land is abundant and milk is wanted in large quantities. Goat's milk is of especial value for infants and invalids.

The goat provides also the chief local milk supply in many parts of the tropic grasslands and the trade-wind shores. I

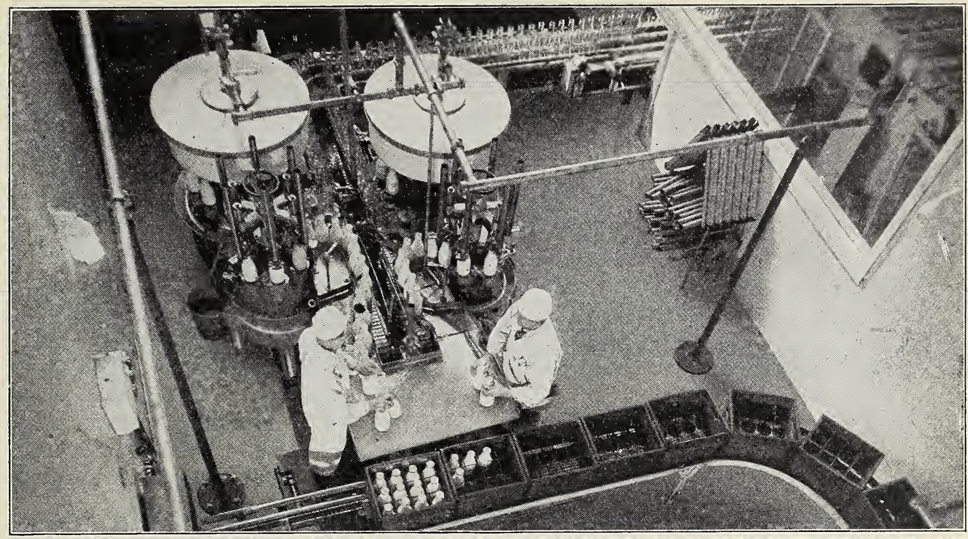


Fig. A. More mass production. Milk from cans, tank cars, and tank trucks is bottled by machinery in city dairies for delivery to the home and grocery.

have seen goats around the thatched or tin-roofed houses of Cuba, Dominican Republic, Puerto Rico, Central America, the Philippines, and Sumatra. They are nearly everywhere in India. Travelers report goats from many parts of the African grasslands, especially from East Africa.

Reindeer milk is a very important food for most of the so-called reindeer peoples (page 40). Reindeer cheese from Sweden can be bought in a few places in the United States.

The cow. The cow gives the human race more milk than do all the other animals combined. This most useful friend of man came out of Asia with our migrating ancestors thousands of years ago. For many centuries her domain has included all parts of Europe except the Far North. After the era of exploration, Europeans took the cow with them to North America, South America, Australia, and South Africa. She is now at home to some extent on all the grasslands, corn belts, and small-grain belts of the world.

The location of dairies near cities. The people of every city wish to buy some fresh milk. Milk will keep sweet for a short time only, and therefore must be sent quickly from producer to consumer. Because of this fact, dairy farms have developed near every city. Now that we have refrigeration and express trains, it is possible to send fresh milk greater distances. Milk trains make runs of several hundred miles every day (Fig. 114-A). The cream pitchers of Boston are filled with cream, the delicious yellow fluid which comes in part from Minnesota, Wisconsin, and Kansas in refrigerated express cars. But the dairies near most cities are still important.

Dairying in New England, the Middle Atlantic States, and eastern Canada. Here farmers have the two main reasons for keeping cows—great city populations eager for milk and farms not wholly suitable for the plow. Because the land is hilly, it should not be plowed frequently; because it is rocky, it cannot be plowed easily—perhaps not at all. But cows can climb over rocks and hills and eat the grass. The grass is excellent because summer in this part of North America is cool and usually

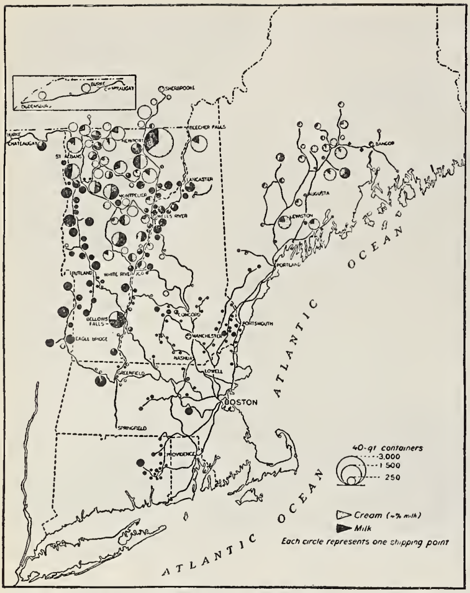


Fig. A. Boston milk and cream supply. How many states and provinces contribute to it? Why does milk come from near and cream from far?

has enough rain to produce grass. Edible grasses do best in a cool rather than in a hot summer.

The silo. The silo (Fig. 196-A) is a clever invention that has done much to aid the dairyman. The corn crop is cut and put into the silo when it is grown but before it is ripe. Almost all dairy farms, even the smaller ones, have one or more silos.

The Corn Belt and the Spring-Wheat Belt. Dairying is more important on the northern edge of the Corn Belt than in the central parts for some of the same reasons that make it important in New England. Another reason is that the farmer has a long, cold season with little work that he can do. Thus the dairy farm is much more important in southern Wisconsin and southern Minnesota than in Iowa. The wheat farmers on the edge of the Spring-Wheat Belt have begun to put up silos, grow alfalfa hay, and have herds of cows. This keeps them busy in winter. Thus much of the butter for the school lunch in New England, New York, New Jersey, and Pennsylvania comes in full carloads from Wisconsin, Minnesota, Nebraska, and the Dakotas. The demand for dairy products in the Eastern States is greater than the farms can at present supply.

Dairying in the Southern States. The Southern States have a long summer in which to grow cow feed, and the dairy industry has increased there in recent years. But much butter, cheese, and condensed milk are shipped from the North Central States and the West.

Dairying in the Western States. How many reasons can you give why a man with a small, irrigated farm in Colorado, Arizona, California, or some other western state might go into the dairy business? Some of these irrigated spots now send butter to points east of the Mississippi River.

Cheese and condensed milk. These two concentrated products afford handy ways of getting milk to distant markets. A hundred pounds of milk makes from 8 to 14 pounds of hard cheese, depending on the kind of cheese. Much of the cheese comes from the same localities that produce butter. Sometimes the same neighborhood has creameries for butter, cheese factories, and milk-condensing plants.

THINGS TO DO AND QUESTIONS TO ANSWER

Influence. See how many different ways you can find in which climate, surface, and soil help or hinder man in the dairy business.

A freight problem. In the North Central States it costs 48¢ to send 100 lb. of butter, packed in tins, second-class freight for 100 miles. It costs 41¢ to send ten gallons of cream (weighing about 100 lb.) 100 miles. If you were a dairy farmer living in this section and could not sell your milk for city use, which would be the cheaper way to market your products, by sending butter or cream? How does this explain the location of many creameries? Explain the statement, "Distant locations produce concentrates," and give all the facts you can that help to prove it or disprove it.

Awarding prizes. We have some ribbons to give away. Blue, first place. Red, second place. White, third place. To what countries or states would you give them if you were judging them as dairy regions? Explain.

Fig. A. Milking in the field in Brittany. The cows are chained to stakes in the pasture field. When the cow has eaten the grass within reach, the stake is moved. By this system, called *tethering*, and much used in Europe, the cows, in long rows, move gradually across the field. The grass is not trampled needlessly and the yield is greater.

UNIT 2—DAIRYING IN OTHER CONTINENTS

PROBLEM. Discover the resemblances between the dairy industry in foreign countries and that in the United States.

Dairying in northwestern Europe. The cool summer weather of northwestern Europe makes better grass than grows in the United States. Also, there are the two main reasons for dairying—hundreds of cities with a population of more than 10,000 people, and many small farms. Small farms must be worked intensively to produce a living for a family, and dairying is one way of doing this. Dairying is therefore important in all the countries of central and northwestern Europe.

The United Kingdom is the largest butter importer. Butter comes by the million pounds from Australia, New Zealand, the Irish Free State, the Netherlands, and, above all, from Denmark.

Denmark is sandy land much like Long Island or southern New Jersey—no coal, no oil, no water power, no iron, no copper, just sandy land—and that far from rich, but having a rainfall sufficient for crops. The people almost *have to be farmers*. What else can they do? By applying brains to business, the Danes have made themselves the most skilful dairymen in the world.

A Danish dairy farmer sitting at his dinner table one summer day looked out the doorway. He looked again, got up, left his unfinished dinner, hurried out, and put blankets on the cows. A change in wind direction had occurred; the cows must not get chilled; that would reduce the amount of their milk.

Ships loaded with butter leave Denmark almost every evening for London, Hull, Newcastle, Leith, and other British ports.

Other countries are copying Denmark's example. The farmers in southern Norway, southern Sweden, Poland, Latvia, Estonia, and Finland are all in situations resembling that of the Danish farmer and are following the Danish plan by turning more and more to dairying and the export of butter. The mountain pastures of Switzerland, the French Alps, and the Jura Mountains make dairying important to that region. The people ship much cheese and milk chocolate.

The dairy industry in the Southern Hemisphere. New Zealand, so very far away from any market for farm produce, has good rainfall and excellent pastures. She has found that by sending butter to the Mother Country she can get cash to pay for the thousands of different things that a little country cannot make and therefore must buy.

Fig. A. This milk goat gave over 4000 pounds of milk in nine months. If a quart of milk weighs approximately two pounds, how many quarts did she give, on the average, each day?

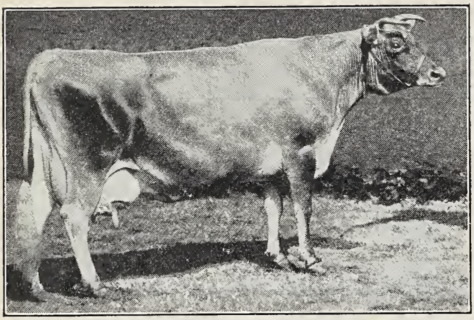


Fig. B. Cow of dairy breed—Jersey breed—from the isle of Jersey in the English Channel. This cow gave 16,657 pounds of milk and 740 pounds of butterfat in twelve months. Four pounds of butterfat make five pounds of butter. Compare her with Figs. 107-A and 116-C. To get the large milk yields and to spend his money wisely, the dairy farmer weighs the food for each cow so that she may get the right proportions and amounts of food elements.

Fig. C. Dual purpose cow. Picture taken in late July at 6700 feet elevation, at her cheese station. She wears her parade collar of ornamented leather, costing $24; also the low-bass bell of the cowbell orchestra.

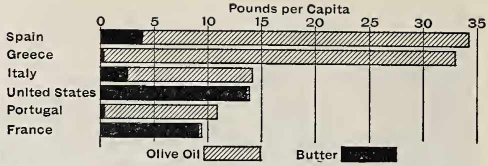


Fig. D. What does this graph tell you about the production of olive oil? of butter? Does climate help to explain?

Australia also exports some butter, but her irregular rainfall has kept the industry from growing as fast as that of New Zealand.

Tell some things that you learn from the table about butter on page 358.

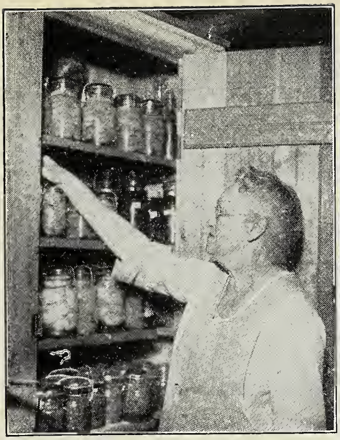
The live-stock industry of Argentina has been going through the same stages that we have found in our own country. First they produced meat, then they turned to the more intensive dairy. Argentina was for a time a butter importer. Then the dairies near Buenos Aires grew to the point where they supplied the home market, and now she has a considerable export of butter to Europe.

The zebu and the Asiatic buffalo. Milk is almost unknown as an article of food in China, although millions of farmers have work cows. In India the hump-necked breed of cattle (Fig. 103-B) called the *zebu* is used chiefly as a work animal. It gives small quantities of milk much like that of the common cow. Some milk is obtained in India, Siam, and Indo-China. In the East Indies a scanty supply of milk comes from the water buffalo. The milk has nearly twice as much cream as that of the cow.

In hot countries milk is hard to keep sweet, and insects and diseases interfere with the efficiency and health of the animals. In 1933 a quart of good milk cost 17 cents in Calcutta, and an unskilled laborer's wage was 24 cents a day. In Bombay the average consumption of milk was only three ounces a day for a person; more than half of the population used no milk whatever.

THOUGHTFUL READING

See who can write the best set of review questions for this chapter.



Figs. A-B. At the left the farmer's wife takes a jar of home-canned fruits or vegetables from her cupboard for the family dinner. At the right is a modern canning factory.

CHAPTER X

THE VEGETABLE INDUSTRIES

UNIT 1—THE NEW IMPORTANCE OF VEGETABLES

PROBLEM. Explain how new knowledge and machines have made vegetables more important.

Vitamins. A Dutch physician in Java, whose name was Eijkman, had a coop of chickens that suddenly got sick. The symptoms were like those of a dreaded disease called *beriberi* which often killed men on long sea voyages. The chickens had eaten polished rice—rice from which the outer coating called *bran* had been removed. The sick chickens all got well quickly when Doctor Eijkman fed them unpolished rice. The bran on the unpolished rice had provided *vitamins*. "Vitamins have been called 'the live element in foods' and their function likened to the 'ignition spark' of the internal combustion engine."*

Vitamins, as their name implies, are vital —absolutely necessary—for normal growth and for health. Foods especially rich in vitamins are milk, fruit, vegetables, liver, cod liver oil, and the germ of wheat. White flour, lean meat, and refined sugar have no vitamins.

Mineral salts. "Only five of the thirteen elements which enter into the composition of the body are present in the carbohydrates, fats, and proteins that supply the fuel or energy needs of the body."* The other eight elements needed for growth and health must come from the mineral salts. Foods especially rich in mineral salts are vegetables, particularly leafy ones, fresh fruits, whole grains, milk, cheese, eggs, and some meats. Doubtless many of the boys and girls who study this book are members of farm clubs, and therefore are studying the rules of health. They are learning to drink more milk and eat more vegetables.

New foods. We now have many vegetables that were unknown to George Washington. For example, about 1850 the tomato was a little wrinkled thing called a love apple. It was considered poisonous by many, and regarded only as a curiosity. We now know that the tomato is an unusually wholesome food, rich in vitamins.

* *Nutrition and Physical Fitness*, by L. Jean Bogert, Ph.D., W. B. Saunders Co., Philadelphia, 1931.

Fig. A. The colonial kitchen with its dried vegetables and fruits hanging from the rafters. The girl is churning milk in order to get butter. Her mother is weaving on a loom. What else do you see?

It has become a standard article of diet for millions. Gardeners have selected the largest and best tomatoes, year after year, and from their seed have developed many large and luscious varieties.

Keeping vegetables. We know many ways of preserving vegetables that were unknown to Martha Washington.

The colonial farm kitchen was festooned often with strings of dried peppers, dried fruit, dried pumpkins, herbs for seasoning and for medicine. In those days each farm supplied its people with what could be grown and kept. Each town ate what grew in the neighborhood. The farmer put away in his root cellar, or in a pit covered with earth, turnips, beets, parsnips, salsify, and cabbage. Perhaps he made a barrel of sauerkraut. Cabbage, with its health-giving qualities, has been a most important vegetable since Roman times.

Canning. Before 1806 a Frenchman discovered that if he heated food to the boiling point and at once sealed it from the air, the food did not change but remained good for a long time. The discovery of canning was not utilized much anywhere until Civil War times. Canned food was fed to the soldiers. Canning then spread rapidly, especially after 1880 when a speedy can-making machine was invented. Millions of housekeepers now can fruits and vegetables in glass jars and tin cans for home use. Commercial canning is now an enormous industry whose products are used in almost every village and found in almost every crossroads store throughout the length and breadth of America, Europe, and many countries in other continents.

Vegetables by express train. George Washington ate vegetables when they ripened in his garden, and as long thereafter as he could keep them. But now night and day, for several months of the year, express trainloads of fresh vegetables rumble past George Washington's old home at Mount Vernon on their way from Southern truck farms to Northern dinner tables. The cars are cooled in summer and warmed in winter. The American home now has three sources of supply for vegetables: those that are grown near-by; those that come in cans from almost anywhere; those that come fresh by express from many distant places. Most vegetables can be bought at all seasons in American cities and towns.

During the week ending April 29, 1933, 15,735 cars of fruits and vegetables were sent to market in the United States. This included 1180 cars of lettuce and 995 cars of strawberries. Central California alone sent 619 cars of lettuce and 366 cars of green peas. There was nothing unusual about this week. It was just an ordinary week in a year when business was bad, but it shows how we bring food from far places in the machine age.

THINGS TO DO

Applying your knowledge. Use each of the following words correctly in a sentence which tells something about the unit: mineral salts, vitamins, cannery, cod liver oil, new foods, leafy vegetables, labels, "supply area," California, Dr. Eÿkman's chickens, factory, tin, glass, kitchen.

UNIT 2—THE AMERICAN VEGETABLE INDUSTRY

> LOCATING FARMS. Explain how and where a man in this country might, with his own labor, operate two truck farms in far separated places. Could he operate three, each having a shipping season of five or six weeks? If so, where?

Soils for vegetables. Cabbage and onions, lettuce and spinach, beets and radishes, peas and beans, watermelons and cantaloupes, and all the other annual plants whose produce we call vegetables or fruits thrive well in sandy soil. Such soil may not be naturally fertile, but it can be made productive by plowing under some or all of the following: green crops, animal manure, commercial fertilizer, or lime. It is fortunate that sandy soil which does not suit grass, hay, or wheat so well can be used for vegetables.

Sandy soil has the advantage of being easy to plow, plant, and cultivate. It dries quickly and therefore can be plowed soon after rain. In spring, sandy soil gets warm more quickly than do heavy clay soils, and therefore can be planted many days earlier. For these reasons the growing of vegetables tends to be specialized on sandy soils.

Differences in climate help to scatter the vegetable industry to all parts of the country. For example, lettuce, a cool-weather plant, comes from the warmest part of our country in winter, but in July and August farmers are harvesting fields of lettuce in cool valleys at 7000 or 8000 feet above sea level in the Rocky Mountains.

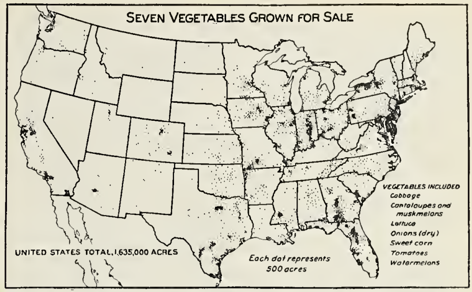


Fig. A. As you read this unit, find each vegetable-growing region which is described.

Fig. B. A vegetable garden. Name as many of the vegetables as you can.

Growing for the local market. Nearly every city in the United States has truck farms near it. A truck farmer grows fields of vegetables very much as other farmers grow fields of corn, but it takes more work to grow an acre of vegetables than it does to grow an acre of grain. The truck farmer who sells his produce in the near-by town does not have to pay railroad freights or put the vegetables in expensive packages. Thus he has an advantage over the grower who ships to a distant market. For these reasons truck farming, which is an intensive form of agriculture, is nearly always found in or near densely peopled localities.

Growing for the early market. Five warm sections along the southern border of the United States make a specialty of sending vegetables to market early, thus getting high prices at a time when there is otherwise little green produce in market. The five sections are Florida, the lower Rio Grande Valley of Texas, the Salt River Valley near Phoenix, Arizona, the Imperial Valley of California and Arizona, and the Los Angeles region of southern California.

Fig. A. If these wet lands were drained, what crops might be raised on them?

In each of these localities one may see farmers busy planting crops in November, December, and January. All through the winter Southern truck farmers cultivate and harvest, much as Northern farmers do along the shores of the Great Lakes in spring and summer.

The truck farmers in these five regions grow a great variety of vegetables which they ship in winter.

South Texas has a great specialty of spinach and onions, which in their season are shipped by the trainload. The Los Angeles region ships much winter lettuce. The Imperial Valley specializes in lettuce and in cantaloupes and muskmelons. If the price promises to be good, the alfalfa fields are plowed to make room for lettuce and melons. If the price is low, the land is sown again to alfalfa to make the more reliable, but usually less valuable, crop of hay.

The farmer who grows vegetables for this early market has a very short season. The truck farmers of Georgia, South Carolina, and North Carolina have a lower freight rate to the great consuming centers of the North and Northeast than do the farmers of Florida or California. When the harvest moves north, prices decline in Florida to such an extent that crops are often left in the field. Similar waste occurs from time to time in almost every vegetable-growing center.

Vegetables for the cannery. The greatest single region for the production of vegetables is on the sandy coastal plain between New York and northern North Carolina (Fig. 119-A). In season, this region sends fresh vegetables to city dwellers near it and to the millions who live to the north and even to the south of it. But the greater part of the crop is taken to hundreds of canning factories whose frame buildings are scattered up and down this region. Small canning factories are located in country villages, beside wharves on the Chesapeake and its branches. Larger factories are in Baltimore, Philadelphia, and the smaller cities of the plain. In June a factory may be busy with peas; in July with string beans; in August and September with tomatoes and peaches; in October with pears and pumpkins.

Similar trucking centers producing for both the near-by market and the canning factory are found along the shores of the Great Lakes from New York to Wisconsin, and also in California. In winter the Lake region sends out thousands of carloads of cabbage which has been stored in cellars until needed. Some of these cars go south. At the same time the more expensive new cabbage from Florida and Texas is coming north.

THINGS TO DO AND QUESTIONS TO ANSWER

The American vegetable industry. 1. What soils and conditions of climate do vegetables and fruits require?

2. What is "truck farming"? Where is the largest truck-farming area?

3. Does the truck farmer need the same amount of labor throughout the year? Compare him with the dairy farmer and the wheat farmer in this respect.

4. What sections of our country grow vegetables for the early market? Fill in a map showing these regions. Fill in an outline map showing all the vegetable-producing areas of our country. Which region leads?

5. Are vegetables always canned where they are produced?

6. What correct answers can be made to the question at the top of page 119?

7. Make a talk about Figure 120-A using the words *resources, future, permanence.*

UNIT 3—VEGETABLES IN OTHER COUNTRIES

AN INTERNATIONAL CONVERSATION. Conduct an imaginary conversation between vegetable growers from four different countries.

Vegetables in Europe. The vegetable industry of Europe is much like that of the United States, but there is much more hand labor (Figs. 121-A and 125-A). As we have special centers along our southern borders, so has Europe. In southern Spain, protected from the north wind by mountains, the fertile plains of Malaga, Almeria, and Valencia face the Mediterranean, catch the southern sun, and are green with winter crops. In the late winter and early spring, while express trains are rushing fruits and vegetables northward through the United States, boats are carrying produce from Spain and other Mediterranean shore locations out through the Strait of Gibraltar, to England and other north European ports. A part of the produce moves to interior Europe by rail.

In these favored Mediterranean spots crops can be produced throughout the year despite summer drought, because water for irrigation is available from near-by high mountains. All summer long in these lands a succession of crops, from earliest lettuce to latest potato, follows one another.

Vegetables in the Orient. The Chinese and the Japanese make greater use of vegetables than do the peoples of the western world. The slogan, "Eat more greens," which American school children hear from the teachers of nutrition, and which their parents hear from the dietitians and physicians, is an old story to the Chinese. One American observer thinks that in some parts of China the food of the people is composed of leaf greens to the extent of 30 per cent of the whole by *dry weight.* The Chinese eat the tips of young alfalfa and many other kinds of leaf greens which are unknown to us. I have seen Chinese gardeners carrying water to irrigate the cabbages that they store in caves and cellars to be kept

Fig. A. Vegetables grown under glass, near Paris, France. The glass roof and the board frame make a new climate so warm that plants can be planted much earlier in the spring and so damp that they grow rapidly. How does the express train interfere with this business of the gardener near the city?

through the winter. I have seen Mongols loading their carts with Chinese cabbages, which they take to the Mongolian desert where no vegetables can grow.

The Japanese make a specialty of radishes, some of which are as long as one's arm. The people eat the radishes in a variety of ways. They make pickled radish which keeps throughout the year and is eaten with boiled rice, dried fish, soy beans, and soy-bean sauce.

Vegetables in the tropics. The people of the grass-hut villages of the Congo, the Amazon, and other tropic forests grow vegetables in their patch gardens in the forest clearings, but they have fewer species than we, in the land of frost, have. The ants and other insects eat up seeds and tender plants. I have seen many a white man plant his tropic garden in old gasoline cans in the attempt to protect the plants from some of the insects.

THINGS TO DO AND QUESTIONS TO ANSWER

Review. 1. Compare the United States with Europe in the production of, and trade in, vegetables.

2. What uses do the Chinese and the Japanese make of vegetables? Are these uses new to you? Explain.

3. Tell about gardens in the tropics.

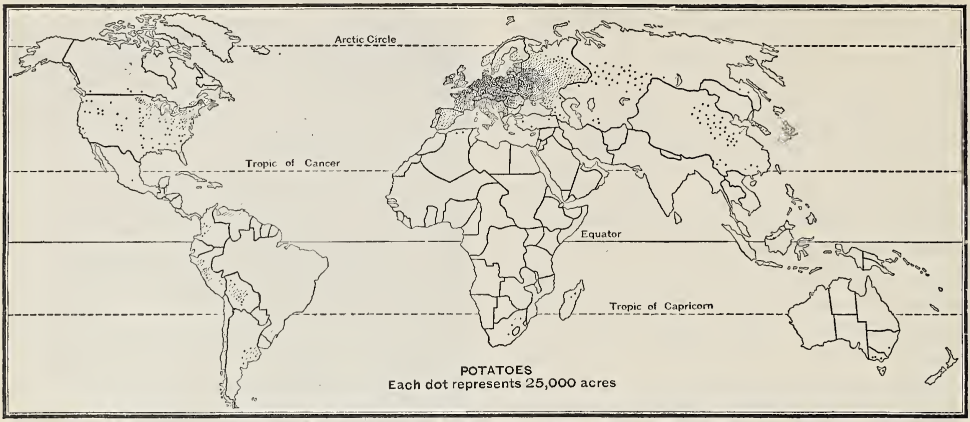


Fig. A. A world map showing acreage planted to potatoes. Each dot represents 25,000 acres.

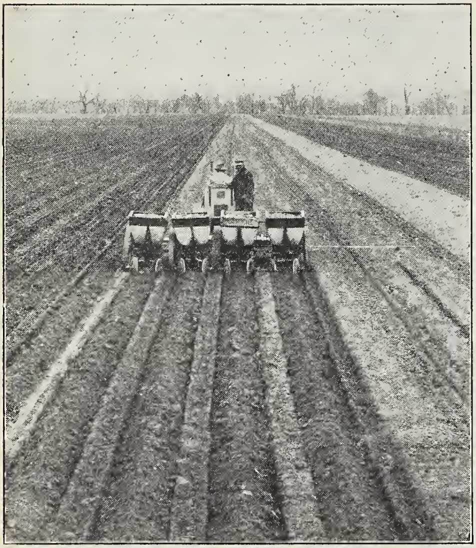


Fig. B. On the level land of the Kaw River Valley potato district of Kansas, two men with this machine planted 200 acres of potatoes in 195 hours working time. This illustrates mass production in planting vegetables.

UNIT 4—WHITE POTATOES, SWEET POTATOES, AND FODDER BEETS

> Crop Location. Shade a map of the world showing the lands where each of the crops mentioned in this unit does well.

The importance of the white potato. The white potato is more generally grown in the American garden than is any other plant, yet its food value shows that it is different from all other vegetables except the sweet potato. What is the difference between its food value and that of wheat, corn, meat, and cabbage (page 377)? With what group of foods does the white potato compete? The potato is called a vegetable.

The fact that the potato is a staple human food, is food for farm animals, and supplies raw material for industrial purposes, gives it a more important place in agriculture than that of any other five vegetables.

Climate best suited to the potato. What July isotherm passes through the small-grain and potato belts? through the corn belts? The potato grows best in a summer that is cooler and moister than that in which corn grows. Therefore the farmer in the potato belt often puts potatoes into his crop rotation as the corn-belt farmer plants corn. Thus he may have oats, clover, potatoes; or sometimes, clover, potatoes; clover, potatoes.

Potato production tends to become specialized in certain districts. What does page 358 tell you about Prince Edward Island? about Maine? Most of the Maine potatoes are grown in one locality—the Aroostook Valley in the northeastern part of the state, where the sandy loam soil seems especially suited to this vegetable. Some farmers there grow a crop of clover,

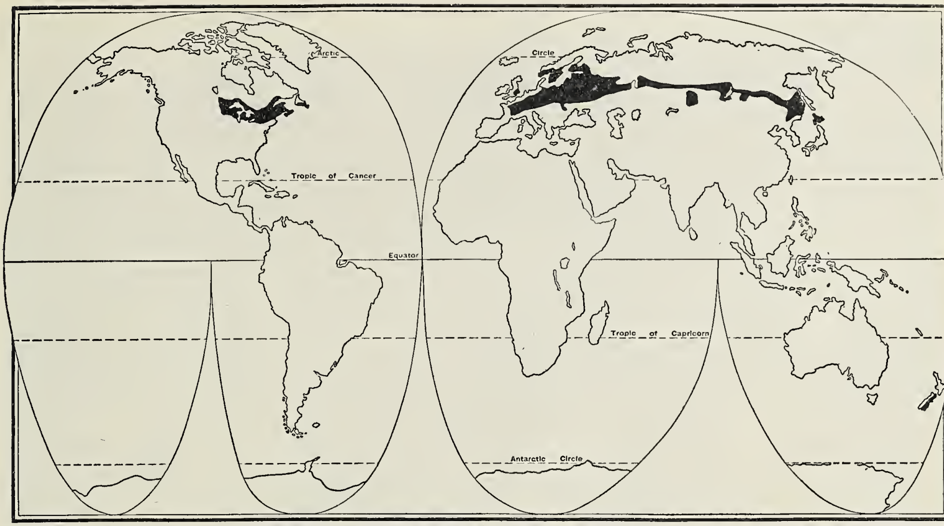


Fig. A. The areas in black on this map have a climate good for small grains, potatoes, and grass. Find these areas also on Figure 2-A.

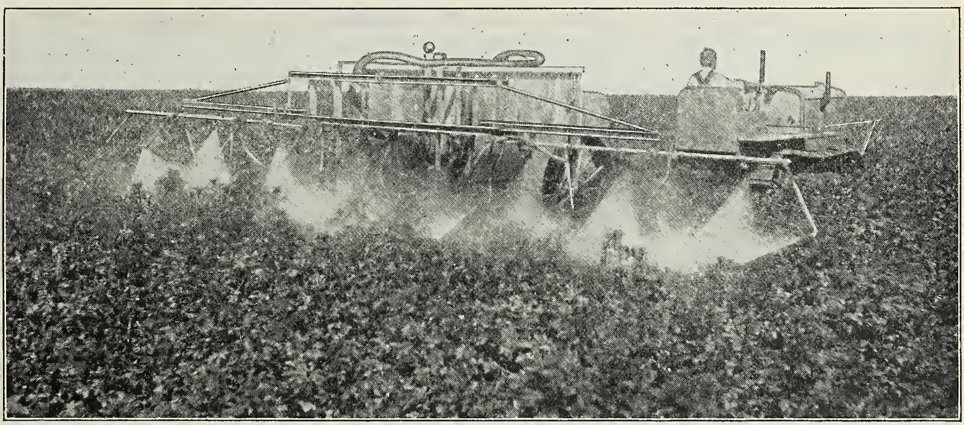


Fig. B. Mass production by killing pests. This tractor lifts up the vines so as not to crush them, pulls the tank of liquid, and runs the pump that sprays eight rows of potatoes at one time. Some farmers spray their potato vines every week. With such care some farmers grow 400 bushels of potatoes to the acre.

plow it under for fertilizer, follow clover with potatoes, and the potatoes with another crop of clover for fertilizer. Some farmers cultivate and spray their potato fields with tractors. If the price of potatoes is good, they can close their houses in autumn and go to Florida for the winter.

The cool plateau climate at the base of the Rocky Mountains (Fig. 122-A) causes the potato to be a very important crop for the irrigation farmer in parts of Colorado and Idaho.

These northern potato belts produce the main part of the potatoes eaten in the United States between September and June. But if you are willing to pay the price, you can also buy new potatoes from December to June. These are grown in the South. Figure 124-B shows that the potato harvest travels northward through a series of

Fig. A. Potato-digging machine sifting 110 barrels of potatoes an acre out of the loamy earth in Aroostook County, Maine. (Insert) The underground part of a potato plant—a marvelous thing in its ability to make good food out of earth, water, and air.

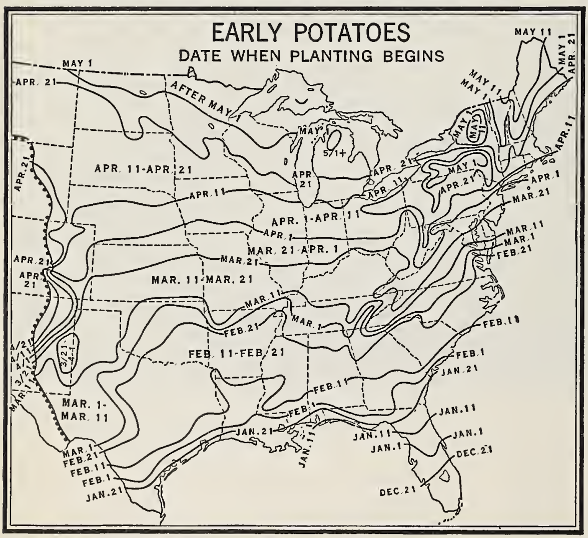


Fig. B. When do Florida farmers begin to plant potatoes? the farmers near Lake Superior? Why is this difference? Why do the lines on the map curve?

potato centers along the Atlantic coast and in the Mississippi Valley.

Potatoes in Europe. What does Figure 123-A tell you about the areas of the small-grain and potato belts in North America and in Europe? The potato also grows well in the cool, moist coasts (Region 8-A) of western Europe. The white potato, so long important in Ireland, is sometimes called the Irish potato.

How many bushels of potatoes to a person are grown in some European countries (page 356)? In the European potato belt, potatoes are food for man and beast. They are used in making bread, candy, and as fuel for the motor car. In the agriculture of northwest Europe, the potato is not only an important food for man, but is also a great forage crop, as it is in the agriculture of east-central United States. Hundreds of millions of bushels of European potatoes are fed to pigs and cows.

Industrial raw material. In Poland, where potatoes are more important to the people than they are in any other country, hundreds of factories manufacture alcohol from potatoes. The alcohol is used in

Fig. A. Harvesting potatoes in France. European farmers use poorer machinery and less of it than American farmers do and produce less per worker. That is one of the great reasons why wages in Europe are usually lower than they are in the United States. In the distance are rows of tall trees along a road.

engines as we use gasoline. Other factories make starch, which is turned into sirup and then into candy. Others make potato flakes for export to Denmark and Switzerland to be used in sirup factories and for stock food. In Europe, potato flour is often mixed with wheat flour. Good bread is made of the combination.

Sweet potatoes and cassava. Does it make much difference to your body whether you eat sweet potatoes or white potatoes (page 373)? The sweet potato is a native of the tropics, where it is grown by patch farmers in both hemispheres. In southern Nigeria, for example, sweet potatoes are the chief food of the natives. Their other important foods are the yam, a cousin of the sweet potato, and the cassava, a bushy plant with a large fleshy root whose food value is similar to that of the potatoes. The sweet potato grows best in the hot summer of the warmer part of the American corn belt and in southern and southeastern United States. It thrives in sandy soils. As with the white potato, we could, if we desired, grow several times as many sweet potatoes as are now grown. Unfortunately, a temperature below 45° F. starts the sweet potato toward quick decay and greatly limits the marketing of this excellent food.

In south China sweet potatoes, grown in terraces on the hills are cut in thin slices and dried in the autumn sun. Dried sweet potatoes are the chief food of millions who cannot get the rice which they prefer.

Mangels (fodder beets). Since the people in northwestern Europe cannot grow corn and many want to keep farm animals, there are many fields devoted to a large, coarse kind of beet, which the farmers store in cellars and use as winter food for nearly all kinds of farm stock. Fodder beets are grown to a small extent in the United States.

THE ESSENCE OF IT ALL

Short talks. Give short talks on food values of the potato; corn climate; potato climate; intensive agriculture; planting time; cassava.

Graphs. Make graphs comparing potato production; yields per acre.

Maps. Sketch maps to show the parts of the world where the potato is more useful than corn.

Pictures. Examine each picture in this chapter and tell what it shows.

For extra credit. 1. Compare the usefulness of the by-products of potatoes, corn, wheat.

2. Study the production and marketing of some vegetable if one is grown near your school.

3. Can some article of food in school so that it will keep until used.

4. Make a special report on one of the products studied in this chapter.

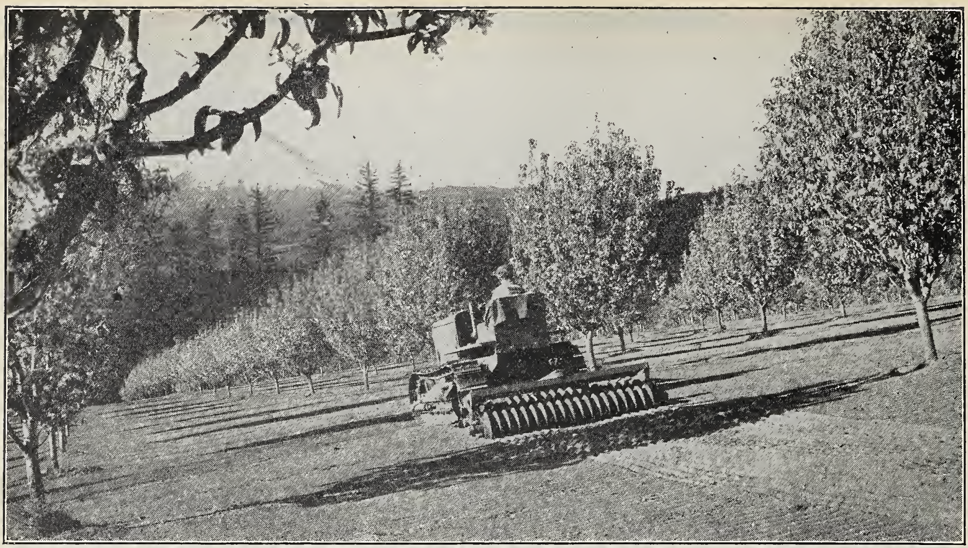


Fig. A. An apple orchard in bloom in the Hood River Valley in Oregon. Snow-capped Mount Hood rises in the distance.

CHAPTER XI

FRUITS AND THE FRUIT INDUSTRIES

Some habits and needs of trees. Trees and some other plants have, growing around their seeds, a nutritious pulp which the trees do not need in producing seeds from which young trees will grow. The pulp—we call it fruit—provides us with a variety of delicious and wholesome foods. Fruit is perishable and resembles vegetables in its transport and marketing problems.

Most fruit trees that grow in lands of frost have the bad habit of blooming in the early spring—sometimes before the season of frost is entirely over. Frost kills the young buds and thus many a fruit crop is ruined and farmers have heavy financial losses to bear.

All fruit trees like deep, porous, well-drained soil, so that their roots may have a large mass of earth through which to search for food and drink.

The fruit trees differ as to types of climate they need. They also differ in the seasons when they blossom and ripen fruit. As a consequence, the fruit industry is scattered over many parts of the United States and foreign countries. Like the vegetable industry, the fruit industry gives rise to much long-distance transport within our country, within other countries, and among countries.

Fruits may be divided into three main groups on the basis of the climates in which they grow:

1. Fruits of cold-season lands
2. Subtropic fruits
3. Tropic fruits

Group 1: Fruits of Cold-Season Lands

Trees that like frost. Trees that bear the apple, peach, apricot, plum, pear, or cherry often have their fruit buds spoiled and their early leaves frozen by frost. Yet if we should take these trees to a land where there is no frost, they would be worthless. The same is true of the grapevine and of the bushes that bear the blackberry and the raspberry.

UNIT 1—THE APPLE

A crop of many climates. The apple is the most important of frost-land fruits. Some apple trees live for a century. Some varieties of apples ripen in early summer. Other varieties, ripening later, will keep in a cool cellar until spring and in cold storage for years. No other fruit keeps so well.

The colonists brought the apple tree from Europe. It is now at home from Nova Scotia and southern Ontario to northern Georgia, and westward to where the Corn Belt ends. The apple thrives in the lower elevations of the Rocky Mountain region, in the cooler sections of the Pacific coast, and in similar climates in both Northern and Southern Hemispheres. Plant explorers searching through Russia have brought back varieties of the apple more hardy than those from western Europe.

Commercial apple growing. In at least three of the types of climate prevailing in central North America, commercial apple growing has developed. One region contains Nova Scotia, one contains Pennsylvania, and one contains western Oregon and Washington. Like corn, apples can be grown over a wide area.

A number of specialized apple-growing districts have developed because the climate was good and some farmer succeeded with a large apple orchard. Seeing his success, his neighbors planted apple trees. These apple districts are, of course, in locations that suit the apple and that have some special protection from frost.

Apples near the Great Lakes. The first region in North America to specialize in apple culture was that part of the state of New York within a few miles of the shore of Lake Ontario. The Erie Canal and early railroads gave cheap transport to New York and to many other cities. Apple orchards now stretch for miles along the lake shore because the cooling influence of the water delays budding and blossoming until most of the danger from spring frosts is past. In the fall the warming influence of the water delays autumn freezes until the

Fig. A. Many fruit trees can produce only fruit if an insect has carried pollen from the blossom of a tree of another variety of the same species. For this reason, orchardists plant different varieties near to each other and often pay the bee man to bring his bees to the orchard at blooming season.

Fig. B. The agricultural experiment station at Geneva, New York, has produced many new varieties of fruits. This figure shows bagged blossoms on an apple tree. See the drawings on page 128.

fruit has ripened and can be picked. For the same reasons, the Canadians grow

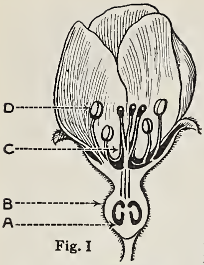


Fig. I

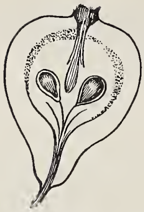


Fig. II

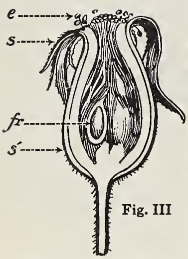


Fig. III

Figure I is a cross section of a blossom of a pear. It is much like all the other fruit blossoms. A is the undeveloped seed; B, undeveloped fruit; D, stamens, which produce pollen, a dust-like substance that falls on C, the pistils, and is by them carried to the undeveloped seed, which then starts to grow. In plant breeding the stamens are cut off, the blossom protected from chance pollen, and pollen of a desired kind is put on by hand. From this seed a new kind of fruit will come. Many new varieties of nearly all crop plants are now being made this way. It is one of the easiest ways by which the world's supply of food and raw materials may be increased. Much more of it should be done. See the book *Tree Crops*, by J. Russell Smith. ¶ Figure II is a cross-section of I after it is partly grown. ¶ Figure III is a cross-section of rose fruit, a cousin of the pear which makes seeds, but no thick, good pulpy fruit as do pears, apples, peaches, and plums.

many orchards of apples, peaches, and plums between Lakes Erie and Ontario. The Michigan farmers grow apples along the east shore of Lake Michigan, and the Nova Scotians grow them in the long, narrow valley called the Annapolis Valley, close to the Bay of Fundy, in southwestern Nova Scotia.

Apples on the Eastern hills. The flat lands where wheat and corn spread their waving tops for a hundred miles at a stretch have a type of climate not good for apples. Apple trees thrive best on hills where there is air drainage. One locality having this advantage is along the Hudson Valley of New York State. Another is in the foothills and ridges of the Appalachians in southern Pennsylvania, western Maryland, northern and central Virginia, and a corner of West Virginia. Other areas that have air drainage are on the hills of southern Ohio and southern Illinois, and the Ozark Mountains of northwest Arkansas and nearby Missouri. Yet another is on the high bluffs overlooking the Missouri River in western Missouri, southwestern Iowa, and northwestern Kansas. Many apples are also grown in the Great Valley of Virginia and West Virginia near the Potomac River. Many Virginia apples are exported to Europe, the West Indies, and South America.

The irrigated valleys. The greatest of all apple-producing sections in North America are the irrigated valleys—Wenatchee, Yakima, Hood River—upon the western side of the Cascade Mountain range, in Washington and Oregon. These valleys have good soil and air drainage, and they receive irrigation water from snow-fed streams. The bright and almost continuous sunshine gives a beauty of color rarely found in apples grown elsewhere.

Hundreds of farmers in the same neighborhood grow apples and many have no other crop. In no other part of the world is apple culture so highly specialized. Many growers in the same valley coöperate in buying supplies. Sometimes they buy a trainload of paper with which to wrap the apples. The growers pack their fruit in coöperative packing houses and sell it through coöperative associations.

There are similar valleys where apples are grown by irrigation in Colorado, Idaho, the Fraser Valley of British Columbia, and the cooler parts of California.

Apples from the Northwest are eaten in almost every town in the United States, in western Europe, and on ships at sea. The boat that brings us bananas from Central America takes back some boxes of apples (page 339).

Apples in the high valleys. The preference of the apple for cool lands and a winter with frost is nicely shown in southern California. The city of San Bernardino, east of Los Angeles, is a great orange center. The oranges are grown part way up the slopes, as shown in Figure 132-A. A few miles distant is a higher valley, the Yucaipa

Valley, whose elevation is more than 2000 feet. This locality is too cold for the orange, but apple orchards line its slopes. Only a few miles away, but many hundred feet below the apple orchards, orange orchards abound.

Apples in Europe. Europe has good apple climate west of Russia, north of the Pyrenees, and south of Scandinavia. But, as is the case with many other food supplies, Europe does not grow as many apples as she needs. Nevertheless, many apples are grown in parts of England, France, the hill sections and mountain valleys of Germany, Austria, and Switzerland. Many Swiss farmers plant apple, pear, plum, and walnut trees beside the roads, and here and there in their fields. They gather the grain, potatoes, and hay that grow beneath the fruit and nut trees.

Apples in Asia. I have never in my life so enjoyed apples as when, having been without them for some weeks, I visited the Vale of Kashmir in March. This valley in the Himalayas stands above the hot plains of India, as does the Yucaipa Valley above the orange land of San Bernardino. One of the chief exports of the Valley of Kashmir is apples which are carried to the apple-less land below in slow-creeping oxcarts.

Orchards of Jonathan apples under Japanese management in Chosen reminded me in every way of those in the United States, from which the Jonathan apple had gone to Asia. Apples grow in northern Japan, Chosen, and North China, but are not important in China and Japan. Instead of apples the people use the more nutritious persimmon, which by careful selection has become a large and delicious fruit. This type of persimmon has been introduced into the United States, where its use is increasing.

Apples in the Southern Hemisphere. What parts of the Southern Hemisphere should have the excellent apple climate of Oregon and Washington? In the Australian states of Tasmania and Victoria and in New Zealand the apple tree grows wild as

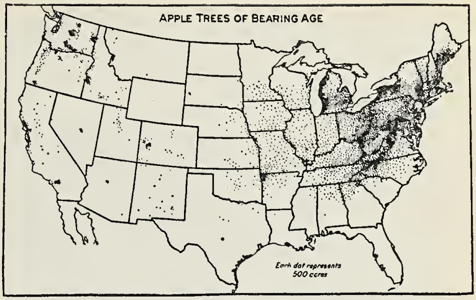


Fig. A. Each dot on this map represents 500 acres planted to apple trees. Give a reason for the many apple trees in Washington State; in Appalachia; along the eastern and the southern shore of Lake Michigan; of Lake Ontario.

freely as in New England or Virginia. Young apple trees from Europe and the United States have been taken to Tasmania, Australia, and New Zealand. In those countries orchards, planted in good hill locations, are cared for in the modern, scientific way. Apples are regularly exported to the European markets. What advantage do fruit growers there have in the season when their fruit is ready for market?

Some fine apples of European and American varieties are grown in the valleys of south central Chile and a few are grown in Cape of Good Hope Province.

THINGS TO DO AND QUESTIONS TO ANSWER

What and where. 1. What is fruit? Is making fruit needed in the tree's business of producing seeds?

2. What are the soil requirements for fruit trees?

3. Name the chief fruits of the group that grows in the coolest climate.

4. On an outline map show the apple-producing areas of four continents.

5. What parts of the United States might benefit by the apple varieties from Russia? Use Figure 2-A in helping to explain your answer.

6. The three main climatic groups of fruits are: ———, ———, and ———.

The industry. 1. Explain apple specialization in North America.

2. Why do apple growers coöperate?

3. Are apples and oranges grown in California? Are they grown in the same place? Explain.

4. Do Europeans and Americans use the same methods in growing fruit?

5. What are the important things to tell about apple growing in the Southern Hemisphere? in Asia?

Fig. A. Pruning peach trees near Paris, France, and fastening them to a south wall to get more heat. By this expensive means peaches, pears, and apples are grown in northwest Europe in locations where they would not ripen their fruit in the open.

UNIT 2—PEACH, PEAR, APRICOT, PLUM, AND CHERRY

A QUESTION OF POLICY. The Government of the Irish Free State has decided to supply the needs of its people as far as it can with home produce. What should it do about fruit?

Industries that resemble the apple. Trees that bear the peach, the pear, the apricot, the plum, and the cherry resemble the apple tree in many ways, but each differs in some respects. These fruits are grown to some extent over almost as wide an area as the apple, but their *commercial* production is usually specialized in rather small localities.

The peach. The peach tree is smaller than the apple tree; its period of life is shorter; it is injured by severe winter cold; and its buds are more apt to be killed by frost. The peach, like the apricot, plum, and cherry, keeps sound for only a few days.

Most varieties of the peach are too soft to stand being shipped to a distant market. Therefore the most delicious peaches can never be bought in the open market, but are found only in family orchards. A few varieties, however, are firm enough to stand the necessary handling of packing, transport, and marketing.

To prolong the season of this perishable fruit, peaches are grown in a succession of places, as in the case of early vegetables. About the first of July the standard varieties begin to come into eastern markets from northern Georgia. The harvest moves gradually northward through the Appalachian hills and the peninsula east of Chesapeake Bay, reaching the lake shore of New York, Michigan, and Ontario in about ten weeks. Similarly, peach harvest moves from Texas to the Ozarks, and from southern California to Idaho.

The advantages of western and northwestern United States for growing fruit. Fruit growing is relatively more important west than east of the Rocky Mountains. It is still more important west of the Sierra Nevada, and is the chief wealth of the Great Valley of California. There factories for canning fruit reach a size and perfection not found in any other state or country, and dried fruit is stored in warehouses in quantities unheard of elsewhere.

Why is fruit culture so important in the Western States? Most of the land beyond the Rocky Mountains has a shortage of water, and must depend in nearly all places upon irrigation. The fruit industry is particularly suited to localities where irrigation is possible because fruit yields an income sufficient to pay for the cost of irrigation. The continuous sunshine of irrigated lands gives the fruit a high color. These regions of little rain suit fruit because the dryness of the air discourages the growth of fungi, of which many varieties attack the leaves of the fruit trees, even the fruit itself, in humid climates. The dryness of the air seems to make the flesh of the fruit more firm. This is especially noticeable in the peach industry. The flesh of peaches from Georgia, Maryland, and New York is not as firm as that of peaches grown in California. A peach of especial firmness is required for canning. Chiefly for that reason California produced,

in a recent year, 8,500,000 cases of canned peaches. The states next in importance in the canning of peaches are Georgia, Michigan, and Utah. Each produces less than one per cent as much as California.

Dried fruit. Some fruit is dried by artificial heat, but the dry air of irrigated lands gives another advantage to the fruit growers in those climates. In the rainless, hot, sunny days of late summer trays of fruit can be spread upon the ground, to dry in the sun. The fruit will then keep all winter and can be carried to distant states and to lands across the seas. You will appreciate the geographic advantage of an arid climate when you remember that three cloudy days and a couple of showers would spoil the fruit completely. And, oh, what a frantic scramble and hurry there is in California in fruit-drying season to pile the trays and cover them when a cloud appears which promises to bring one of the rare summer showers!

Specialized varieties of fruit. The drying and canning give interesting specialization of varieties. The flesh of the varieties of peach grown for canning is firm. In many of the varieties the flesh clings tightly to the stone (cling peaches), and must be cut loose. The peach used for drying has softer flesh. You can break open such a peach with your fingers, throw away the seed (free stone), and lay the two halves to dry.

The California summer suits the fruit-drying industry so well that, except for apples, this state does nearly all of the commercial fruit drying for the country and is also a great exporter. No longer, except in the case of apples, do the farmers of the East build drying houses and try to dry fruit by a fire. California now dries more than three pounds of prunes (a variety of plum) for every man, woman, and child in the United States. Prunes are cheap and are widely used throughout the land.

Relative freedom from spring frosts. The Pacific coast, receiving most of its

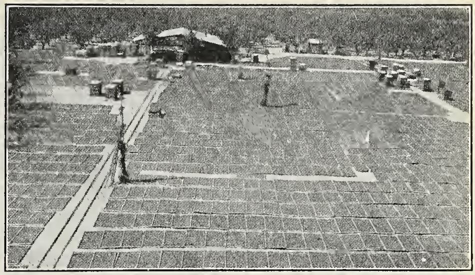


Fig. A. A sun-drying yard for fruit in the Santa Clara Valley in California. Dipping shed in the background.

Fig. B. Each dot on this map represents 500 acres planted to peach trees. Note the early peach district in Georgia; the late peach district near Lake Ontario; and the canning and dried-peach district in California.

winds from the west, has an oceanic type of climate. Also the Sierra Nevada and Cascade ranges protect the valley of California and the valleys of western Oregon and Washington from cold winds which might blow out from the interior. This protection is so marked that at times the cold wind from the interior blows through the narrow gorge which the Columbia River has cut in the Cascade ranges, and freezes the fruit for a few miles around. Meanwhile, ten miles away, the mountain protects orchards from the cold east and northeast winds.

The valleys of California, being farther south, have less danger of spring frosts than have Oregon and Washington. The relative frostlessness of spring gives to California a practical monopoly of the apricot crop of the United States. The apricot *tree* is hardy. It will thrive in many eastern states, but it *will* bloom in spring before the danger of frost is over. Therefore an apricot tree anywhere east of

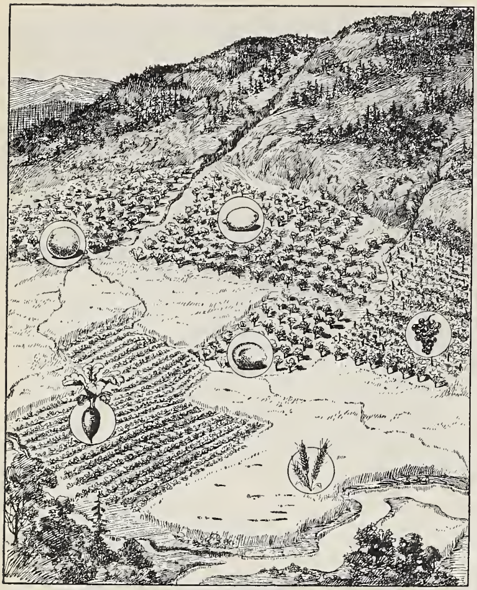


Fig. A. Drawing of a section of a valley near Pasadena, California, showing how streams have built up a wide-reaching alluvial fan with gentle slopes, good for air, drainage and irrigation. The most frost-resisting crops, beets and grain, are at the bottom of the valley, then come orchards of peaches and apricots, and vineyards, then groves of lemons and oranges in the most frost-free locations, and finally the forest trees.

the Rocky Mountains seldom matures a crop. The growers in California succeed in getting a crop almost every year. Several hundred thousand tons of apricots are dried annually, and many are canned.

The pear. This fruit is plagued by certain species of fungi which under certain conditions, especially that of moisture, live in the bark of the pear tree and kill the twig, the branch, or even the trunk. Fungi are carried from tree to tree by insects. A pear tree in the dry California summer is less subject to fungus blight than is a pear tree in the humid East. This, combined with frost protection, gives to California most of the commercial pear crop of the United States. Oregon and Washington are California's chief rivals.

The cherry. The dryness of the Pacific coast summer (Fig. 23-C) seems to give the fruit a firmer flesh than does the more humid East. Therefore most of the fresh cherries that reach the market in the United States come from the Pacific coast and the Rocky Mountain regions, although the Great Lakes sections of New York, Michigan, and Wisconsin produce as many cherries as does the Pacific coast. The Great Lakes cherries, however, are mostly of sour varieties, grown almost exclusively for canning.

Some berries. Blackberries and raspberries grow wild over a large area and are cultivated in a few centers. They prefer the cool summer of New England and lower Canada, and have their greatest commercial development in the cool Pacific Northwest.

Fruit in Europe. The climate of northwestern Europe is too cool for the peach, but is excellent for plums, cherries, and pears. These fruits are grown in most countries. Nearly always they are found in small orchards or even on a few scattered trees, but not in the large-scale method common in the United States. This is true also of fruit grown in Mediterranean countries, which have long exported dried fruit. These countries have suffered severely in recent years from the competition of the superior American product, which undersells them in European markets.

Peaches are grown in Spain, Italy, and southern France, but large quantities of American dried peaches go to Europe.

Fruit in the Southern Hemisphere. From what you know of California, find the places in the Southern Hemisphere (Fig. 2-A) which might rival California in fruit production.

Almost every variety of fruit tree grown in our Pacific coast region has been planted in localities having similar types of climate in Chile, South Australia, the irrigated lower Murray Valley of Victoria, Tasmania, and New Zealand. Most varieties have also been planted in Cape of Good Hope Province. These fruit growers of the Southern Hemisphere have followed the methods of California, Oregon, and Washington. Each region supplies its home market with

nearly all kinds of fruit. Each sends something to the European market. In each, as in the United States, there is much room for expansion. Meanwhile, in these countries as in the United States, so much fruit is grown that in some years the farmer does not even pick it. He would lose more money if he did so. This is true of every one of the fruits about which we have been studying.

The world market. Now that we can keep dried fruit and canned fruit for months and carry it cheaply halfway round the world, we can say that we have a *world market* for some fruits just as we have a world market for wheat, meat, and butter. The fruit importers of northwestern Europe can take their choice of half a dozen countries—indeed, of half a dozen continents—as to where they will buy their raisins or prunes, dried peaches or dried apricots, canned peaches, cherries, pears, or any other of a long, long list.

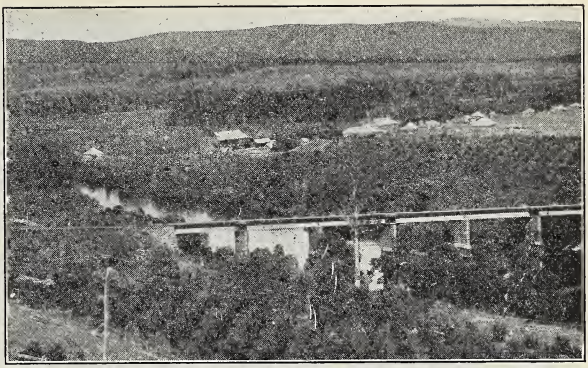


Fig. A. Fruit orchards on slopes in Tasmania. If you should leave out the stream, a picture much like this might be taken in any one of thirty American states, in Ontario, several European countries, Chile, Cape of Good Hope Province, Australia, or New Zealand.

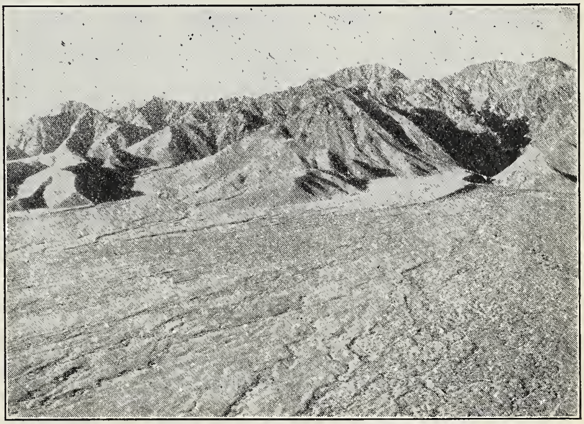


Fig. B. This Mongolian desert scene shows how streams cut canyons in the mountains and spread earth, sand, and gravel in great fanlike slopes. This one is 10 miles long and 2000 feet high. See how another joins on the side. Many such fans make a gently sloping land like the Great Valley of California. Much land surface in drier parts of the world is made this way. Figure 132-A shows how such land is sometimes used.

THINGS TO DO AND QUESTIONS TO ANSWER

What is your answer? 1. The leading peach-canning state in America in 1929 was ———. How close were its rivals? ———. Why? ———.

2. Does the apple enter into specialization as much as the pear, peach, etc.? Explain. Other things being equal, which would you rather grow, an apple tree or a peach tree? Why?

3. Why has California switched from wheat to fruit production? Explain.

4. Do seasonal variations have the same effect on peach-producing areas and apple-producing areas?

5. What relation exists between the production and the canning of fruits? between climate and drying?

6. Compare areas of fruit specialization with areas of cattle specialization.

7. The state of ——— leads in apricots. Why?

8. What states lead in pear production? Why?

9. Tell some important things about European fruit production.

Geography and trade. 1. On an outline map of the Southern Hemisphere show the fruit-producing areas. (See Figure 2-A.)

2. What trade do these areas have? Why?

Testing your neighbor. Write a dozen or so incomplete sentences about the facts contained in this unit. One such sentence might be:

Our largest early-peach district is in———

Exchange your sentences with one of your classmates. He will try to complete your sentences. You will try to complete his sentences.

Fig. A. Capri, near Napoli. A sheltered, beautiful, and densely populated nook between the mountain and the sea. Terraces, some of them supported by stone walls, hold in place the earth which is intensely cultivated—vineyards, orchards, gardens, and some of wheat and beans. This land has been cultivated for two thousand years.

UNIT 3—THE GRAPE

International Competition. Why should one rather than another of the following countries win the British raisin market: Spain, Australia, Union of South Africa, Chile, United States?

The vine. The grapevine, with its popular products—fresh fruit, dried fruit (raisin), and wine—is one of man's long-time friends. Grape seeds have been found in Egyptian tombs over 3000 years old. In the Bible the grapevine is mentioned often and lovingly.

Grapes will not grow in the cool climates of England and extreme northwestern France. Therefore our European ancestors, seeing the huge wild grapevines of the Atlantic coast, were astonished and delighted. The Norse explorers called our country Vinland.

The Jamestown settlers brought French or Italian grapevines, and hoped to make their fortunes from wine. The vines, because they were from the Mediterranean type of climate with its dry and fungus-free summer, perished with leaf blight in their new environment.

Grapes in regions having the Mediterranean type of climate. The grape fits splendidly into the Mediterranean type of climate. Its deep roots enable the vine to get enough water without irrigation in lands of little rain where most crops fail. Therefore grapes are grown on the dry hillsides and uplands in every country from Palestine to Portugal. They are also grown in southern and central France, on sunny slopes in Switzerland, and along the banks of the Rhine in western Germany. In all these countries the grape harvest, with wine making in some sections and raisin drying in other sections, is one of the important agricultural periods of the year.

Certain soils produce grapes that give wines of particular qualities. Certain limestone hills in Burgundy, in central France near the city of Dijon, are especially famous. I have seen there an old wine press said to have been made by the Duke of Burgundy in 1248, and still in use.

When France took possession of Algeria and Tunisia the grape industry was introduced. North Africa has now become one of the great wine-producing regions of the world.

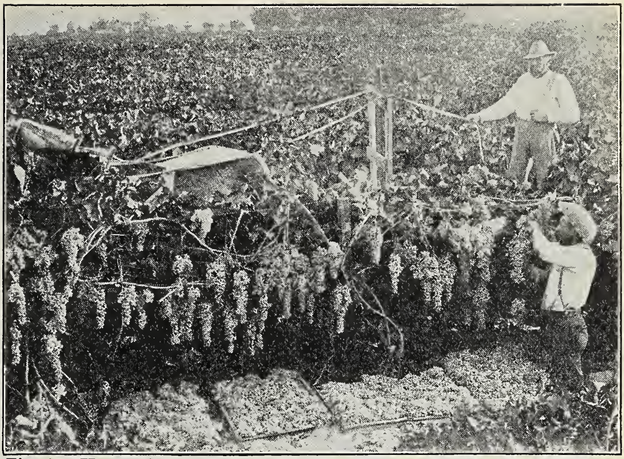


Fig. A. Harvesting grapes. Tell at least five parts of the world where a scene like this could be photographed.

Mediterranean varieties of grapes—having tight skins—were taken to California in the early days by the Spanish settlers and more recently by farmers. The vines flourished in California, and that state now produces several times as many grapes as all the rest of the United States does. California has almost a raisin monopoly. It ships thousands of cars of fresh table grapes with tight skins, and also grows large quantities of grapes for wine.

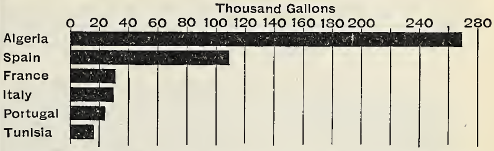


Fig. B. The leading wine-exporting countries and the yearly export of wine from each country.

Every region in the Southern Hemisphere having a Mediterranean type of climate has a grape industry like that of California, and there has been, in recent years, a fierce international competition for the raisin market. Who are the exporters of table raisins and of wines (page 358)?

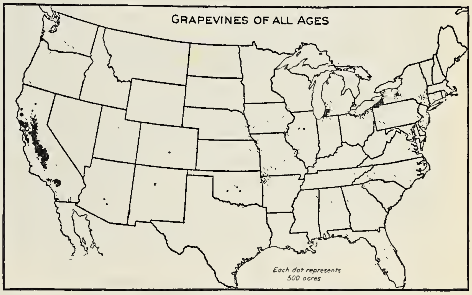


Fig. C. Each dot on this map represents 500 acres planted to grapes. Make a statement about lakes and grapes; about alluvial fans and grapes.

American varieties. The Mediterranean varieties perished of blight in the humid eastern United States, but we have developed many good varieties (having slip skins) from native wild grapes. They are grown in family gardens over a large area. But the commercial grape industry is centered chiefly along the shores of Lake Erie, Lake Michigan, and a number of small lakes in central New York known as the Finger Lakes.

THINGS TO DO AND QUESTIONS TO ANSWER

Questions and problems. 1. Use outline maps of the continents to show the chief grape-producing areas of the world.

2. Which type of climate best suits the grape? which type of soil? Why?

3. Of what significance is the fact that we received 8,000,000 pounds of fresh grapes from Argentina in April and May, 1933?

4. What do the Figures 135-A and 135-B tell you?

5. How did the Norse explorers give the Europeans a wrong impression of America?

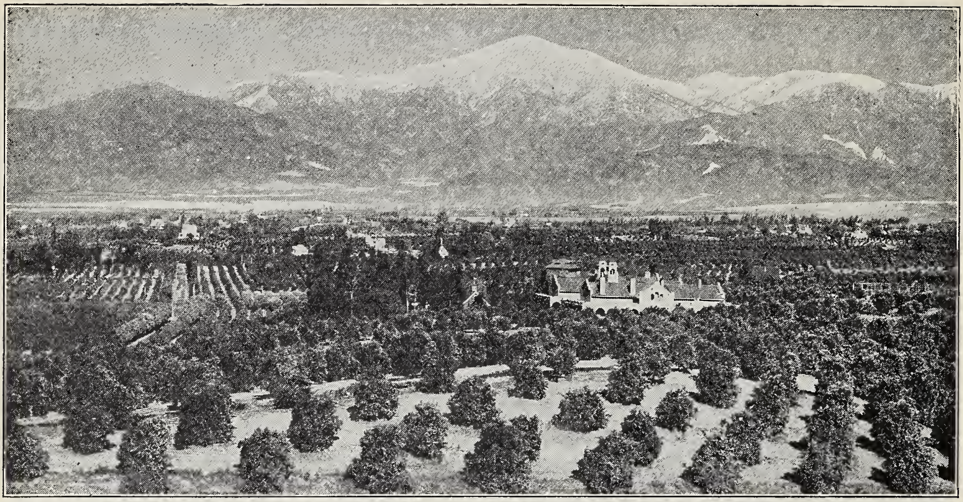


Fig. A. Looking down from Smiley Heights upon the orchard-clad slopes above Redlands in the southern California orange district. Why does plenty of snow on the mountains in the springtime make the valley people happy? This picture is taken from a place near the top of an alluvial fan (Fig. 132-A).

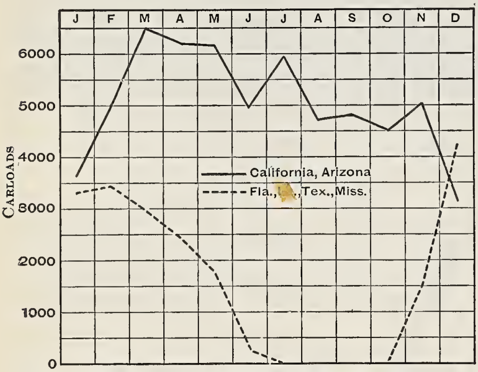


Fig. B. How does this graph of carload shipments of oranges for a recent year show the importance of having two types of orange climate?

Group 2: The Subtropic Fruits

UNIT 4—CITRUS FRUITS, OLIVE, AND FIG

> PROBLEM. Make a list of the persons who may have had something to do in the process of getting an orange to the fruit store ready for you.

Citrus fruits. The orange, the grapefruit, the kumquat, the lemon, and the lime are called *citrus* fruits.

Climate for citrus fruits. Citrus fruit trees are greedy for water, and in semiarid climates must be irrigated. They are at home everywhere in the wet tropics, and can stand some frost. Despite occasional frost injuries to trees and crops, the cultivation of citrus fruits has increased rapidly in the last thirty years in Florida, southern California, and southern Texas.

The citrus fruits thrive in two very different types of climate: the California-Mediterranean with its dry summer, and the Florida climate with its wet summer. This is fortunate for the people of the United States, because, as is shown by Figure 136-B, lands having these types of climate cannot ship oranges equally at all times of the year.

Origin of the orange. The sweet orange is a native of the peninsula of southeastern Asia between Burma and China. Since time immemorial, the orange has been cultivated in India and South China. It was widely distributed throughout the East Indies when white men first discovered those archipelagoes. The orange was carried to southwestern Asia by the Arabs, and it probably reached Italy before the fourteenth century. The Spaniards took it to Florida and tropical America.

Increasing use. The use of oranges has increased greatly in the United States in the last thirty years, and the grapefruit crop has risen from 12,000 boxes in 1899 to 29,000 carloads in 1931. Like the increased use of vegetables, the increased use of citrus fruits is due partly to the improved transportation provided by the express train.

As is the case with apples and other fruits, citrus fruits are at times produced in greater quantity than the market will take at a price profitable to the grower.

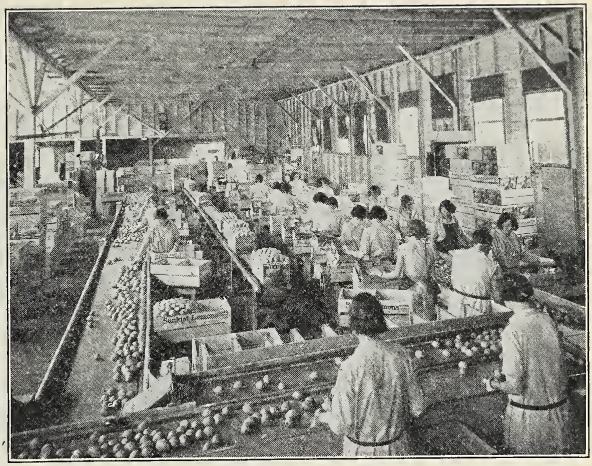


Fig. A. Mass production in the packing house. A moving belt carries the lemons past the two sorters in the foreground. One grade they put in the box between them, one they lay on the second belt. The good ones are carried onto the third belt at the right, which carries them past the double row of packers. Find the moving belt that carries the full boxes.

Oranges in Europe and Asia. Europe has no regions with a warm, damp summer like that of Florida. Therefore oranges in Europe are produced in the Mediterranean region, where the summer is dry and rain comes in winter. Spain, Italy, and Palestine are the chief producing countries. Their orange orchards along the coast have had a rapid increase in recent years.

For many centuries the orange has been a home crop in southern Japan, southern China, India, and all lands between.

Fig. B. Date trees with fruit. This crop tree from the oases of Sahara and Arabia yields much more food an acre than any grain. Good dates are now grown in the Imperial Valley of California on trees from Africa. Our chief supply comes from orchards irrigated by the waters of the Tigris and the Euphrates and shipped from Basra.

Orange production in the Southern Hemisphere. The importance of the two types of climate that suit the orange is well shown in the Southern Hemisphere. The section of Chile with Mediterranean climate produces oranges as does California, but on a much smaller scale, while Paraguay takes the place of Florida and ships large quantities of oranges by boat downstream to the great cities on the river Plata.

In South Africa oranges of the type grown in the Mediterranean region are grown in Cape Province. Oranges like those in Florida are grown in Natal. In Australasia Mediterranean oranges are grown in the irrigated region along the lower Murray River in South Australia and western Victoria, while the Florida type of orange is produced in the coast districts near Sydney. In New Zealand the Florida type of orange is grown chiefly in the northern part of North Island.

The Southern Hemisphere is too far from European markets to compete with oranges grown in Florida, California, the West Indies, and along the Mediterranean.

Fig. A. Irrigating a California orchard. Why do you think this system is called *basin irrigation?*

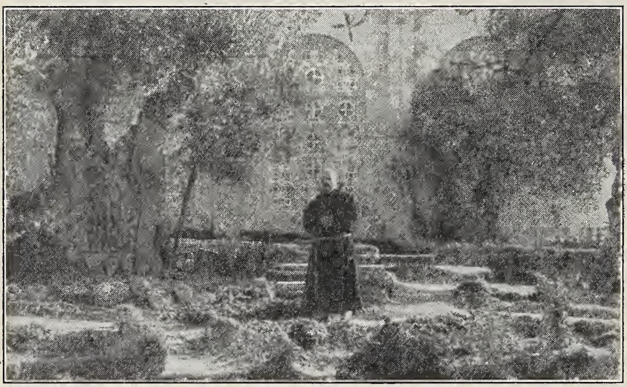


Fig. B. These olive trees in the Garden of Gethsemane (an olive orchard) just outside of Jerusalem are said to have been there at the time of Christ. It is possible, for I have seen olive trees in Tunisia which I know were planted before A. D. 640.

The lemon and the lime. Lemon trees and orange trees are about as much alike as wheat and barley. At first you might easily mistake one for the other. While the methods of growing and shipping the two fruits are almost identical, there is, however, one difference. Due to the fact that the lemon is injured more easily by frost, it is grown in the more frost-free locations. In the United States these locations are chiefly in southern California. In Italy they are chiefly on the island of Sicily. Lemons were exported in large quantities from Sicily to the United States before we developed the citrus industry to its present extent.

The lime, much like the lemon, is grown chiefly in the frost-free tropics, and comes to the United States chiefly from the West Indies and Mexico.

Citrus fruits in tropic countries. Citrus fruits are grown for home use in nearly all tropic countries, and might be grown in greater quantity. Puerto Rico, with the aid of American experts, has begun to export grapefruit to the United States.

Fig and olive. The fig tree and the olive tree are kind to man in regions with the Mediterranean type of climate. Like the grape they need little water and grow without irrigation on the hills above the orange orchards. In central Tunisia, where the rainfall averages only seven inches and occurs only in winter, I have seen olive orchards stretching as far as the eye could see. Picking olives and crushing and pressing out the oil is one of the main autumn jobs in Spain, Portugal, Italy, Greece, and Palestine. There olive oil largely takes the place that butter has in our diet.

Some olive trees are grown in all regions with Mediterranean climate, but as yet the crop is commercially important only in Europe and North Africa where cheap labor produces low-priced oil.

The fig is a delicious fruit when eaten fresh, but we know it best when it is dried, very much as other fruits are dried. The fig is an important food in many localities. The production of figs has spread as has the

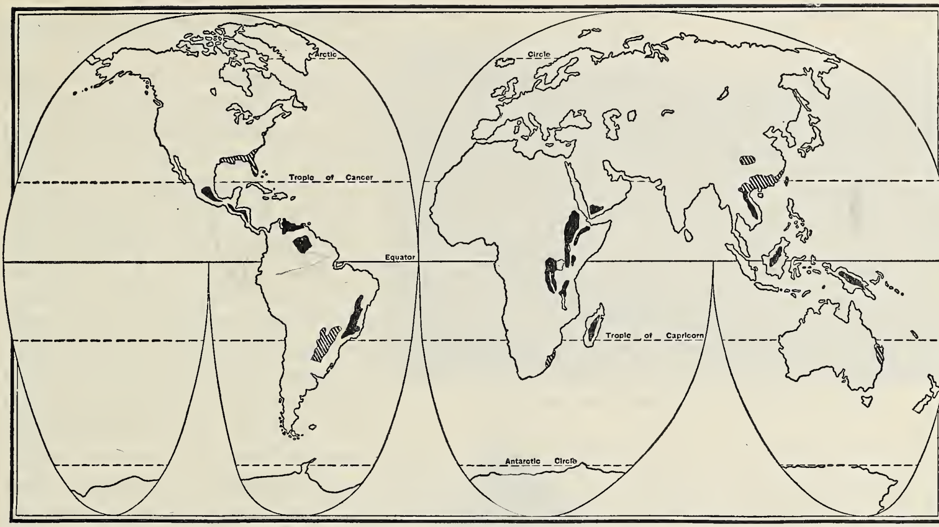


Fig. A. The black areas on this map are tropical uplands—much cooler than the neighboring lowlands. The ruled areas have a climate much like that of Florida. See these areas also on Figure 2-A.

Fig. B. Durian, a tropic fruit unknown in the world market. This wonderful fruit has such a terrible smell that strangers can scarcely stay in the house with it, but the flavor is so good that they eat it, nevertheless.

production of olives. The chief exporting center is Ismir on the coast of Asia Minor. California is increasing the shipment of figs to the United States markets.

What food elements do the fig and olive give us? (Page 373.)

DO YOUR OWN THINKING

Writing sentences. Write a dozen incomplete sentences about the facts contained in this chapter. Exchange papers with a classmate and try to complete his sentences.

Group 3: The Tropic Fruits

UNIT 5—TROPICAL FRUITS AND THE TROPIC PLANTATION

THE FUTURE. Give a talk about "Tropic Fruits and Future Possibilities."

Many fruits. The lands without frost have a great variety of fruits—most of which are so tender, perishable, and difficult to transport that they are unknown to persons who have not traveled in lands where they grow. For example, the mango is declared by many people to be the most delicious fruit in the world. It is produced on a huge tree which is at home throughout the moist tropics. I have seen its dark-green foliage towering far above the houses in the Philippines, Sumatra, India, the West Indies, and Central America, but the fruit of the mango, like that of the peach, is too perishable to stand the sea journey. Even if it could stand the journey, it would reach our markets when they are choked with peaches, summer apples, pears, grapes, and almost our whole list of fruits and vegetables.

The avocado, or alligator pear, like the mango, grows around the world in its lati-

Fig. A. A pineapple plantation in Queensland.

Fig. B. The house at the right belongs to a Central-American plantation that sends us bananas. Except for the board window, it is made from materials that grew near-by, with the aid of shovel, ax, and the machete, a long knife.

tude as does the apple farther north. It is sometimes offered for sale in our seaboard cities for 15 cents to 45 cents a fruit. Avocados have a food value unusual among fruits. What is it? (Page 373.) Can you tell, by examining the food-value table, why a dish of boiled rice and chopped avocado is popular in Puerto Rico?

The banana. One tropical fruit, the banana, can come to our markets in good order because it can be picked a week or more before it is ready to be eaten, and while it is still green and as hard as a firm apple. What foods are like the banana in the nourishment they give us? (Page 373.)

An old friend. Many people think that the banana came from the same place as did the orange. Many species of the banana family are growing wild today in southeastern Asia, and some were cultivated so long ago that they have *entirely different names* in the Chinese language, the Malay language, and in Sanskrit (an ancient language in India). Migrating peoples carried banana shoots with them to islands of the Pacific. The first white explorers found bananas being grown in Hawaii, on Easter Island, and on Tahiti which had 28 varieties. When people from Java migrated in their boats to Madagascar, they took banana shoots with them. Thence it went to Africa. When the Portuguese explored the coast of West Africa in 1474, they found the banana and carried it to the Canary Islands, whence it was spread to all parts of tropical America where the climate suited.

Bananas on the patch farm. The banana plant sends up suckers from the mother root. It is easy to separate a sucker for planting. In a little more than a year the plant will grow to a height of 15 to 30 feet, and a bunch of bananas is ready for food.

The banana cannot stand a touch of frost, and unless irrigated it requires as much rain as would support a forest.

Raw bananas, and the big, coarse cooking variety called *plantains*, are the rivals of cassava in furnishing starch food to millions to whom bread is almost or quite unknown.

It is convenient, therefore, to have a few banana plants growing beside the grass hut. Perhaps that fact explains why this plant has spread throughout the tropic world where sufficient rainfall exists.

Plantation bananas. When the Americans and Europeans discovered how good bananas were, they wanted them. But bananas cannot be carried profitably from the tropic shore to New York or London

except in especially cooled chambers on a fast ship. If the chambers must be especially cooled, they must be large enough to carry many bananas in order to make a profit. The patch farmer could not produce so many bananas. The transportation of bananas requires special ships and docks suitable for rapid handling of the fruit at New Orleans, Mobile, Baltimore, Philadelphia, New York, Boston, Providence, London, Southampton, Hamburg, and Havre. On the railroads running inland from these ports bananas must be shipped in cooled cars or heated cars. Therefore the banana business must be organized on a broad scale.

Hundreds or even thousands of acres of fertile plain or valley land are often included in one great banana field, with little railroads running through it to carry the bananas quickly to the ship. The method whereby one kind of crop is produced on a large scale is called the *plantation system*. Farming of this type is new in the tropics. It requires managers, foremen, accountants, machinery, engineers, inspectors, and expert and speedy work. It is an example of *modern business organization*.

Sometimes the field work on the banana plantation is done by hundreds of laborers who live in barracks. Sometimes the banana company allows the laborers to use patches of land on which the workers build grass houses and raise a part of their own food. When the banana ship comes, all must work. I saw 417 men at work loading a ship at a little town on the Central American coast. The ship arrived from New York at 5 A. M. Forty thousand bunches of bananas were cut in that one day. During the night they were hauled by train to the pier and were carefully loaded into the hold of the steamer. We sailed for New York at five o'clock the next morning, and the workers then slept.

What countries are the chief banana shippers? (Page 358.) The British colonial governments of tropic West Africa leave farming in the hands of the native. He can grow cacao trees and dry the beans and take his time about marketing them, but he cannot organize a banana plantation.

The pineapple. Much tougher than most tropic fruits is the pineapple. We import fresh ones from the West Indies and Hawaii, but receive most of our supply in cans from Hawaii, where there are large plantations. The Chinese gardeners near Singapore make that city an important center for canning pineapples.

THINGS TO DO AND QUESTIONS TO ANSWER

The banana story. 1. Tell as many different true stories as you can, starting with "I am a banana."

2. I am a banana plant. This is my story ———.

3. My visit to a banana plantation ———.

Some comparisons. 1. Name the chief tropical fruits. Compare the trade in tropic fruits and frost-land fruits. In your explanation use facts about the banana.

2. What food value has the avocado? What is its price? Compare it with some other fruits.

3. Where do we get most of our pineapples? in what form?

4. What localities in the United States should produce the same products that are found at the foot of the Andes Mountains in Argentina (Fig. 2-A)?

5. What does Figure 132-A tell about differences of weather in short distances?

CHAPTER SUMMARY

A few debates involving facts and thought. 1. Resolved: That fruits are more valuable for their food value than are vegetables.

2. Resolved: That subtropic lands are more valuable for their fruits than tropical lands.

3. Resolved: That California is the most valuable fruit-producing area of its size in the world.

Questions requiring thought and study. 1. Examine all the figures in this chapter and tell what you see to help you make talks on: (*a*) Fruit growing is (or is not) a scientific business; (*b*) it is (or is not) a form of intensive agriculture.

2. How many people have anything whatever to do with producing and bringing to you the orange you eat?

3. Where is a natural place for the supply of pineapples to Sydney, Capetown, Buenos Aires, New York?

4. What kind of soil and climate do fruit require?

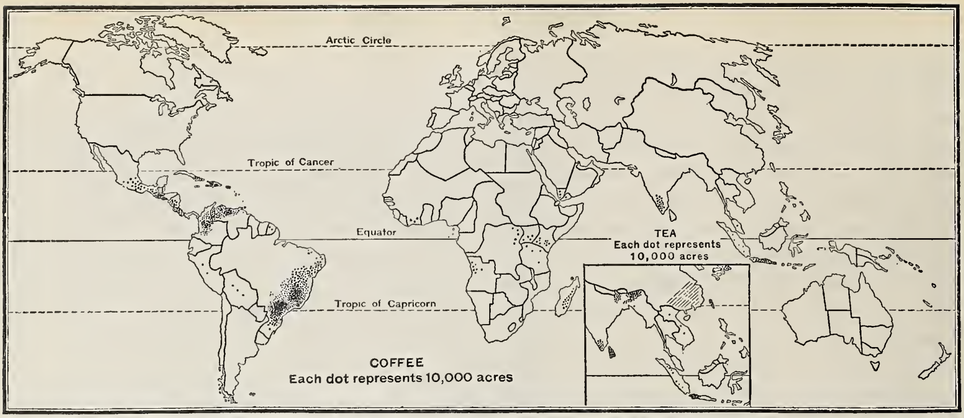


Fig. A. Find from this map the chief coffee-producing areas in the world; the chief areas which produce tea. Compare the coffee areas with the tropic uplands shown in Figure 139-A.

CHAPTER XII

COFFEE, TEA, CACAO, AND SPICES

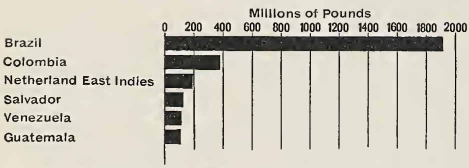


Fig. B. The leading coffee-exporting countries of the world. The coffee plant came originally from the Eastern Hemisphere.

Many hot beverages. A cup of hot coffee or tea starts millions of people on their day's work. Tea and coffee, once luxuries for the rich, were among the early products to gain a world market.

Many other products are used locally in many lands just as tea and coffee are used, but only these two have attained a world market. The United States is the largest importer of coffee and Great Britain is the largest importer of tea.

UNIT 1—COFFEE

> THE TRANSPORT FACTOR. Explain how the high cost of a pound of coffee has caused coffee to be grown in many isolated places.

Origin and spread of coffee production. Coffee grows wild on the uplands of Ethiopia (Abyssinia). The people there have used it as a drink for ages. The Arabs got coffee from the Abyssinians. Today, in thousands of Bedouin nomad camps, delicious Arab coffee is the greatest luxury. The culture of coffee outside of Abyssinia began in the near-by uplands of Arabia and went to India, to Ceylon, and to the uplands of Java. People in the Mediterranean lands got it from the Arabs in the seventeenth century, and in 1718 the British governor of Jamaica raised some coffee trees. Coffee culture spread thence to the other West Indian islands, to Central America, Mexico, and South America.

Grains of coffee. The coffee berry looks like a small cherry, and contains two grains of coffee bedded in pulp. Sometimes the pulp is removed by drying the berries on stone floors in the sun (Fig. 144-B). Sometimes it is removed by machinery.

Climate and soil suited to coffee. The coffee tree is particular about climate. It does well in a hot climate—but not too hot. It can withstand a little frost. Coffee needs well-drained red soil, rich in potash (page 197). It needs good air drainage, because gentle breezes made by air flowing down mountain sides help to keep fungi from growing on the plant. The coffee tree also needs much rain, rather more than does corn—70 to 120 inches a year—and it needs a short, dry season for the harvest period.

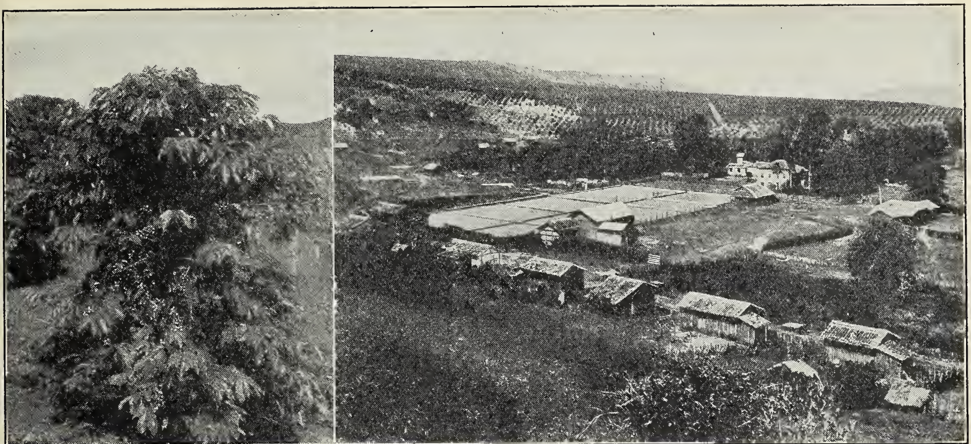


Fig. A. At the left is a coffee tree in full bearing. Fig. B. At the right is one of the great Brazilian coffee plantations. How do the hillsides in this picture show that coffee is a land killer, like corn, cotton, and tobacco? How does the outdoor drying floor (the white pavement divided into squares) show need of rainless days?

These conditions exist at their best on tropic uplands. We have already found (page 27) on both sides of the Equator wide, hot areas of land with a rainy season and a dry season. These two wide zones reach entirely around the earth near the tropics of Cancer and Capricorn. The highlands in these zones provide the most suitable land for coffee.

Coffee from small areas. Many places have a coffee climate, but some of these are too small to be shown on our map (Fig. 2-A). For example, some coffee is grown on the highlands of Puerto Rico, of Jamaica, Haiti, the edges of the Mexican plateau and the plateaus of Yemen in Arabia, and also on the uplands of Ceylon and Java.

In the mountainous areas of Mexico, Central America, and the Andean countries, the coffee land is made up of small tracts, such as bits of plateau or little pockets in the mountains, or steep land along the sides of steep valleys in the mountains.

Coffee is an important crop for the people on the plateaus of Central America, of Colombia, and of Venezuela. A little very fine-grade coffee is grown in small spots along the eastern slopes of the Andes, in Peru and in Bolivia.

As the British introduced coffee into Jamaica, so have the colonial governments of European colonies in East Africa introduced it to the upland regions there.

Brazil leads in coffee production. On page 142 the graph of coffee exports shows which countries are the chief exporters of coffee. Brazil leads, because she has more resources for producing coffee than has any other country. Brazil has a wide, rolling upland, like that of the better parts of the Piedmont plateau in North America. Here the coffee planter, instead of having five or ten acres or less, as is often the case in Colombia or Venezuela, may have a single tract containing 500 or 5000 acres, nearly all of which is splendid for coffee. In the state of São Paulo alone there are a thousand million coffee trees. Twenty estates each have over a million trees.

Just as we have cut down the forests in our own country to make cornfields, so the Brazilians have cut down their forests to make room for coffee plantations.

The Brazilian coffee region is near the ocean. A short railroad takes the coffee to the ports of Santos and Rio de Janeiro. The land is high enough to be comparatively free from swamps, mosquitoes, and malaria. Italian immigrants have come by the tens

Fig. A. Oxcart on Costa-Rican plantation taking coffee to the *patio* or drying floor.

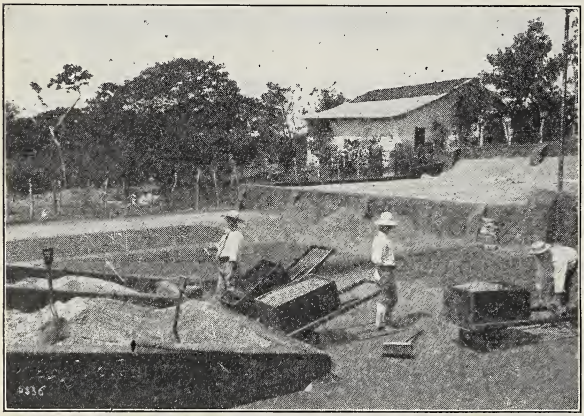


Fig. B. The *patio*, or drying floor, of a Costa-Rican coffee plantation.

of thousands to work in the coffee plantations. In the Andes and Central America, coffee is often the money crop for the patch farmer who produces most of the food and tools that he uses.

Brazil has true *plantations*, where hundreds of workers grow only one crop and buy most of their food.

Brazil not only leads the world in coffee, but she has produced so much coffee that there is danger of its becoming so cheap that it will bring financial ruin to the producer. For years the government has been trying to limit the quantity in order to keep up the price. Coffee has even been burned as locomotive fuel.

The low price of coffee in recent years made it impossible for Brazil to buy as much food and other products from the United States and other countries as she had previously bought. Brazil, therefore, has been growing more foodstuffs.

Coffee and the world market. Coffee is costly, it keeps a long time, and is an excellent commodity for world trade. Transportation has greatly changed the list of things for which there is a world market and a worldwide trade. In George Washington's time the world market had but a few things—silk, spices, tea, coffee, and a few other costly things. Today there is a world market for the staples of everyday use—wheat, corn, iron, coal, lumber, cotton, wool, gasoline, fertilizer, and many other things.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. Can you explain why the inaccessible places in which coffee is grown have affected the price a pound?

Map. Make a map showing the coffee regions of the world and the area having climate much like that of Brazil's coffee region.

Things to think about. 1. Trace carefully the origin and spread of coffee.

2. The coffee of Brazil is grown in an area of less than 100,000 square miles. What proportion is that of the whole territory (page 366)?

3. The chief coffee ports of Brazil are ——— and ———.

4. Tell about little coffee plantations and big coffee plantations.

5. What effect does the price that Brazil receives for coffee have upon her ability to buy automobiles and other needful things?

6. Does the United States produce and export all of the products studied thus far? Explain.

Problem. Explain *world market* and changes in the *world market.* How did coffee and tea gain a world market?

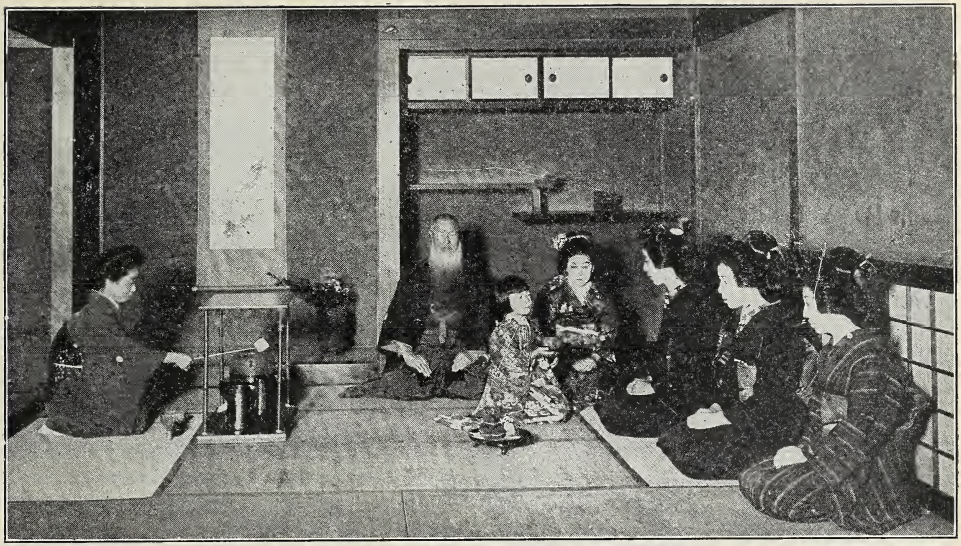


Fig. A. Japanese tea ceremony. Making, serving, and drinking tea in a perfect manner is supposed to cultivate precision, courtesy, and poise. The Japanese sit on the floor and sleep on the floor. Tell how that influences the cost of living.

UNIT 2—TEA

Resources and Policy. Could the United States grow tea? If so, why do we not do it?

The origin of tea drinking. One day, while I was walking with friends in the Chinese province of Shensi near the big bend of the Hwang Ho, we came to a beautiful spring at the foot of a wooded hill. We stopped to drink. The Chinese gentleman who accompanied us begged us not to drink the water. He said that the cold water would make us sick. For centuries he and all his people had drunk only boiled water.

The Chinese have lived in great numbers for a long time on small farms, where the soil has become so saturated with manure that the water from the wells is filled with disease germs. Cold water, therefore, made the people sick—not because it was *cold* but because it was *germ laden.*

Those who found out ages ago that *boiled* water was safer than unboiled, made a great discovery. Probably the next discovery was that of finding that tea leaves improved the flavor of hot water.

When the Chinese or the Japanese farmer, thirsty from the long hours of labor on his field, takes a drink, it is often weak, hot tea. Even today, if you enter one of the better stores in a Chinese or Japanese town, the proprietor may offer you a little cup of tea, unsweetened and unflavored, as all the Orientals drink it.

Climate for the tea tree. Tea requires a fertile, well-drained soil and a moist summer with plenty of rain to enable the tree to stand the strain of having its leaves plucked several times. The tea plant thrives in our Cotton Belt and similar climates and also in the wet tropic climate. A slight frost does not injure the tree.

Tea on small farms in Asia. In parts of China and Japan a few tea trees on small farms are almost as common as are potatoes in an American garden. In many localities some of the land that cannot be made into paddies is planted to tea trees. Many of the farmers sell a little tea very much as the American farmer sells eggs. Only in a few places in China and Japan are there large plantations of tea trees.

Producing tea. Cultivating, pruning,

Fig. A. Maté trees, in northeastern Argentina, seven years old, yielding twenty pounds of dried leaves, each, at a harvest.

and fertilizing the trees; plucking and rolling the leaves; drying, firing, and grading the tea require much labor, some of it very skilful labor. One process of curing the leaves makes green tea; another makes black tea.

Tea leaves in boxes, or tea leaves and twigs held together in the form of a brick called *brick tea*, have long been an important article of commerce from China into Russia and the interior of Asia.

Plantation tea in Asia. The British rulers of India and Ceylon have introduced tea into those countries because they desired to get a money crop for their colonies, an investment for their financiers, and to supply the home country with produce grown within their own empire. The chief centers of Indian tea production are located on the rainy hills of Assam, northeast of Calcutta, and in the southern highlands. Tea is grown also on the uplands of Ceylon and Java.

Most tea is grown on plantations, some of which are hundreds of acres in extent. Scores or hundreds of workers live in the company houses for a season or for years and work in the plantation under an expert manager. Later they return to their homes.

Quality, inspection, and trade. What do the figures in Table 27 show you about gains and losses in tea trade? In China each tea farmer makes his tea in the way his father and grandfathers had taught him, and while it may be good tea and he may be properly proud of it, it may not be just like his neighbor's tea. Therefore the merchant who buys it cannot be sure just what it is he is buying when he buys China tea. In contrast to this, the British tea planters of Ceylon work hard to keep their brands of tea uniform so that the merchant who buys tea of a certain brand knows what he is getting.

Tea in Europe. In 1610 some Dutch traders, having learned to drink tea while visiting the Chinese, took some tea to Europe. Tea became very popular in some European countries and of little importance in others.

Tea in the United States. The tea tree thrives in southeastern United States and in other parts of the world having the type of climate suited to corn, cotton, and rice (Fig. 66-A). But so much labor of skilful fingers is needed to produce a crop of tea that our tea costs several times the price of that produced by the low-paid workers of the Far East.

Native American teas. The American

Indian used a kind of tea made from the leaves of the cassina bush, which grows from Norfolk to the Rio Grande, and which contains caffeine, the stimulating element of coffee.

The South-American Indians of the Paraná Valley drank a tea made of the leaves of the maté tree. Maté trees grow wild over a large area of northeastern Argentina, Paraguay, and southern and southeastern Brazil.

The Spanish settlers of Argentina and Uruguay got the maté habit from the natives. Now the people of Argentina use about twenty pounds of maté annually for each person. Because of this, a great trade in maté has grown up.

The trade in maté and maté culture. Argentina grows about 20,000 tons of maté, and imports nearly 80,000 tons. About nine tenths of the tea comes from Brazil; the remainder from Paraguay. Maté is also exported to Chile. Returning Italian and Spanish laborers have introduced it into Europe.

There are very few regularly planted orchards of maté. The maté grower usually chops rival trees out of a maté thicket. When grass begins to grow, he turns in the cattle to pasture the grass. Thus there are two things to sell—cattle and the leaves of the maté. The leaves are stripped rather carelessly and are then dried for shipment.

Which has better chance of being grown in the United States—tea or maté? Why?

Fig. A. Tea pickers have low wages. Point out elements in low cost of living in this tea-pickers' meal of rice eaten with the fingers.

Fig. B. Picking the young tea leaves on a plantation in Ceylon.

THINGS TO DO AND QUESTIONS TO ANSWER

Things to think about. 1. Explain how the Chinese are scientifically minded but do not realize it.

2. What kind of soil and climate does tea require?

3. What is the trade in maté? Compare its culture with that of tea.

4. Which could be grown to better advantage in the United States, tea or maté? Why?

5. Make a map showing the tea-producing areas of the world.

6. Examine Table 20 on page 358 and tell several things that you learn from it. Can you tell from it whether a nation is rich or poor?

7. Compare the tea export of China with that of the British areas. What happened to China's tea-export trade?

Problem. Give a talk about uniform quality and the export trade; and the trade of your neighborhood. See whether the advertisements in the newspapers and magazines give you any information on this subject.

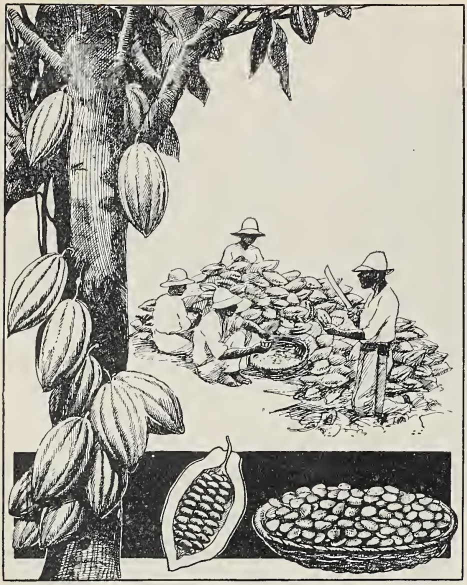


Fig. A. From this drawing tell why the cacao tree grows chiefly in the zone of calms. The natives are breaking open the pods to get the seeds from which chocolate, cocoa, and other products are made.

UNIT 3—CACAO

> Grow Cacao? If one of your class wished to grow cacao in a country where it is not extensively grown, where might he go? Would you advise him to do it?

The food of kings. Cacao was the food of kings in Mexico; it was there that the white man first saw it. The Swedish botanist Linnaeus named the tree *Theobroma cacao*, from *theos* (god) and *broma* (food). Cacao is *a food* as well as a drink. In the forms of cocoa, chocolate, milk chocolate, candy, and flavoring it has become a prized food for millions.

What does page 362 tell you about the popularity of cacao and its products?

Climate suitable for cacao. The low, thick-topped cacao tree is a child of the equatorial forest. It requires some shade and is grown only in hot lowlands where the soil is deep, rich, and moist. The big cucumber-like fruits cannot withstand strong wind. Therefore the tree must be grown either in the zone of calms (page 26) or in sheltered valleys, away from the wind.

Cacao culture. Culture of the trees is simple. The planter cuts down most of the other trees on his land, plants cacao, then chops down grass and weeds; that is all. Rain, heat, and rich soil will do the rest unless plant diseases break out, as they have a habit of doing when trees are crowded. The cacao tree produces greenish pods, each pod containing from twenty-five to forty seeds (beans). The reddish beans, when ground to a very fine powder, make chocolate. When half of the fat is taken from chocolate powder, *cocoa* remains.

Changing centers of production. Cacao is grown near Guayaquil in Ecuador, in the Amazon Valley in Brazil, in northern Venezuela, and in parts of the West Indies and Central America. What was the rank of Ecuador as an exporter in 1890? 1910? 1931 (page 362)? A blight attacked the cacao trees in Ecuador, but the growers did not take the trouble to fight it.

Colonial governments have been very energetic in introducing cacao culture in lands where it was unknown, but which had a suitable climate. The government of the British Gold Coast Colony in West Africa has supplied the natives with planting stock; it has taught them how to grow and harvest the crop and how to fight the blight. The government has also furnished a transportation system to take the produce to the ports. The great cacao crop of this colony is nearly all grown on the small farms of the illiterate natives.

Making milk chocolate. By combining chocolate, milk, and sugar, milk chocolate is manufactured in the dairy sections of Pennsylvania, New York, Massachusetts, California, and Wisconsin in the United States, and in England, the Netherlands, Switzerland, and France.

THINGS TO DO AND QUESTIONS TO ANSWER

Problems. 1. If one of your class wished to grow cacao in a country where it is not extensively

Fig. A. Zanzibaris drying cloves. Clove trees in the background.

grown, where might he go? Would you advise him to try to grow cacao there?

2. Examine the table of cacao statistics, page 362, and tell something about the popularity and the ups and downs of new industries. Find facts in this table to prove statements in the text.

Cacao facts. 1. Compare the food value of cacao and milk.

2. Cacao requires what kind of climate? what kind of culture?

Map. Show on a map the cacao-producing areas of the world; the milk chocolate-making areas of the world.

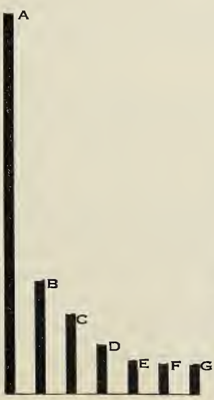


Fig. B. The seven leading cacao-exporting countries:

	Metric Tons
A. Gold Coast	241,336
B. Brazil	70,000
C. Nigeria	50,047
D. Trinidad	29,717
E. Dominican Republic	26,000
F. Ivory Coast	20,000
G. Venezuela	20,000

UNIT 4—SPICES

The Changing World Market. How do spices and wheat show that there have been important changes in what is called the world market?

Flavoring for food. For centuries the food of most of North Europe was somewhat lacking in what we call flavor. Even the oven for baking bread was unknown in most parts of Europe until a few centuries ago. The people grew weary of eating porridge (water, meal, and peas boiled together) day after day, so someone made the rime in Mother Goose:

"Pease porridge hot!
Pease porridge cold!
Pease porridge in a pot,
Nine days old!"

Spices and the world market. Spices originally came from India and the islands beyond. Because it was so costly to carry them by caravan, only the rich could use spices. After ships reached the Far East, the price diminished and the trade in spices increased.

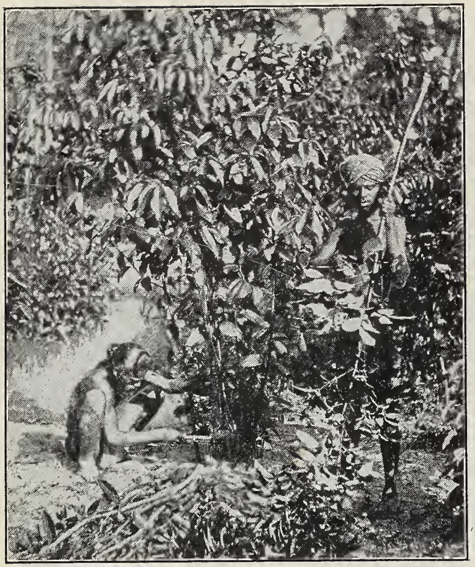


Fig. A. Ceylonese cutting cinnamon.

Spices and silk were for a long time the great items of trade between East Asia and West Europe. Venezia and Genova fought each other; Portugal, Holland, and England vied with one another for the monopoly of the spice trade. This in turn made Genova, Venezia, Lisboa, Amsterdam, and London rich. Each city was the great center from which European merchants bought their spices.

All the spices except mustard come from the tropics and all require much tedious labor.

Spices show the great change that has happened in world trade. Spices are sold in greater quantity than ever, but they are now minor products, because cheap transport and machine production have allowed such cheap and bulky things as wheat, lumber, phosphate, paper pulp, iron ore, petroleum, and coal to become the staples of world trade.

Mustard. This spice is the seed of the mustard plant, which is grown in much the same way that wheat is grown. It thrives in a cloudy climate. Most of it is grown in the Baltic section of eastern Germany and Poland.

Cinnamon, cloves, and pepper. The plants producing these three popular spices are like all the other tropic spices in that they need the type of climate that suits the banana (page 140). Four hundred years ago the Portuguese were interested in Ceylon only because it produced the bark of the cinnamon tree, which the kings of Ceylon exacted as taxes. The people were compelled to go to the forest and peel cinnamon bark from the wild trees. Now it is grown in plantations with European managers, much as tea is grown.

Pepper vines, like lima beans, are grown on poles. They produce their little round seeds as climbing beans produce their fruit. Most of the world's pepper comes from the Netherlands East Indies and the Malay Peninsula.

Cloves, the blossoms of a tree that was once a state monopoly in Java, are now shipped to the extent of 9000 tons a year from the island of Zanzibar. Madagascar has begun to grow cloves, too, and exports annually about 3000 tons.

Some other spices. The world buys annually nearly 5000 tons of nutmegs, the seed of an evergreen tropic tree found in Netherlands East Indies, and about 1500 tons from the little West-Indian island of Grenada. Allspice, seed of another tropic tree, is shipped only from Jamaica. This tree grows in pasture fields. The boys and men climb up the trees and break off fruiting twigs. These twigs are then picked up by Negro women and children and dried in the sun.

Ginger, the root of a tropic plant, grown in much the same way as garden truck is grown, comes chiefly from Sierra Leone and India.

Centralization and specialization in production, which we have already noted in the fruit and vegetable industries, are excellently illustrated in the production of spices.

The existence of great areas of unused tropic forest makes it plain that the supply of spices could be increased manyfold if the demand existed.

Fig. A. Spice from our own land. This large field near Griffin, Georgia, is planted to pimientos, a variety of sweet pepper, the fruit of which is used in salads and as a flavoring for cheese.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. Why did spices once exceed wheat as an article of trade in the world market?

Spice facts. 1. How do spices compare with the fruit and vegetable industries as a farm crop?

2. Where do the following spices come from? cinnamon? pepper? nutmegs? allspice? ginger?

3. Why do wheat, lumber, and paper pulp exceed spices in importance in world trade? Explain.

4. What European cities became wealthy over the spice trade?

5. What were the first spice-producing areas?

CHAPTER SUMMARY

A map. Make a map of the world and put on it all the spice and beverage information you can.

Explanations. 1. Tell the results that would follow from the discovery of a way to make oil of cloves cheaply in a chemical laboratory.

2. Examine all the pictures in this chapter and then make a talk about "cost of living" and "intensive agriculture."

3. Why is our cacao not manufactured in the countries that grow the beans?

4. If the price of coffee doubles, will Brazil grow more or less of food products?

5. Tell about the production in the United States of the articles mentioned in this chapter.

Some completion statements. Copy and complete each of the following statements:

1. Cold water therefore made them ———, not because it was ———, but because it was ———.

2. The chief coffee ports of Brazil are ——— and ———.

3. If you enter a store, the proprietor may offer you little cups of tea, ———, and ———, as all the Orientals drink it.

4. Coffee originated in the uplands of ———.

5. The coffee tree needs as much rain as ———.

6. The coffee tree needs a temperature described as ———.

7. The coffee tree needs soil of ———.

Making graphs. Using the facts contained in the statistical Appendix construct the following graphs: 1. The per capita consumption of tea in 5 leading countries.

2. The per capita consumption of coffee in 5 leading countries.

3. The export of tea in 5 leading countries.

4. The export of cacao in 1890; 1910; and 1931.

Testing your neighbor. An excellent method of reviewing this chapter, or any other chapter in this book, is to construct a series of multiple-choice questions similar to the question shown below. Only one of the four possible answers is correct. Then pass your questions to a classmate and have him underscore the correct answer to each question.

The world's largest exporter of coffee is (1) United States (2) Brazil (3) British Empire (4) Colombia.

Fig. A. A maple-sugar orchard in Vermont. See the cans to catch the sap as it runs from the trees.

CHAPTER XIII
SUGAR
UNIT 1—SUGAR AND THE SUGAR PLANTS

Fig. B. Boiling sap from the maple tree in order to make maple sirup and maple sugar.

PROBLEM. Show some ways whereby man can create new resources.

Sugar is popular. Do you know a boy or girl who does not like sugar? Many animals are just as fond of sugar as we are, and cheap molasses is now used as food for farm animals. Sugar is a nutritious and energy-giving food.

Beyond doubt the earliest sugar industry was that of the bees, which gathered tiny quantities of sugar from the flowers (Fig. 127-A). Among men, the earliest sugar industry took the form of stealing honey from the bees' nests. In Roman times honey was the chief source of sugar in the Mediterranean world.

The sugar tree. The American Indian was well supplied with sugar. He found wild honey in hollow trees. He also knew that in spring the sap of the sugar-maple tree contained a little sugar. He knew he could get this by boring a hole in the tree and sticking in a hollow reed or concave piece of bark through which the sap flowed into a bark trough or other receptacle. The Indians dropped hot stones into the sap, boiled off the water, and got sugar. There is still a local industry in making sugar, centered chiefly in Vermont and Quebec. The cost of maple sugar is more than that of other sugar, but its flavor is liked by many people.

The sugary canes. There is some sugar in the corn stalks and much more in some of the sorghums. Sorghums are regularly grown and crushed to obtain sirup or molasses (Fig. 158-B). The tropical sugar cane

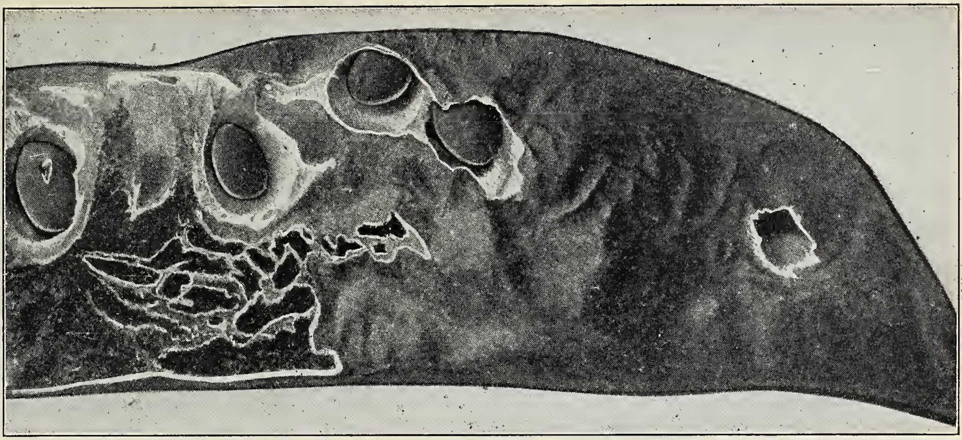


Fig. A. Life-size picture of *part* of a honey-locust bean. It was seventeen inches long and had 29 per cent of its weight in *sugar*. I know of no other sugar plant so rich. In addition, it had a substantial amount of protein, the most expensive stock food. What should be done about this bean tree?

(probably a native of the Ganges Valley) contained enough sugar to make it worth growing for the juice. The people of India began to grow sugar cane so long ago that the plant is not now known in its wild form. Columbus took it from Spain to Haiti in 1493.

The Spanish soon started to grow sugar cane in other islands and were followed by the Portuguese in Brazil. The English, French, and Dutch governments had sugar plantations in the West Indian Islands through the 1600's and the 1700's. They seemed to value these possessions most extraordinarily, for sugar was a luxury and was greatly prized.

The sugar roots. During Napoleon's wars, the English fleet blockaded the French ports and cut off the trade of France with her West-Indian sugar colonies. Napoleon ordered his scientists to discover sugar-yielding plants that would grow in France. They examined the sap of many plants. The onion, which sometimes has 8 per cent of sugar, was discarded for the larger beet with its larger yield to the acre.

Beets yielded but 3 per cent of sugar in the first sugar industry, which was aided by a subsidy from Napoleon. From that time until the present, the sugar beet has been grown in Europe for its sugar. Year after year the sweetest beets were saved for seed. By this process of selection the sugar content has risen until now the sugar beets of Germany and Czechoslovakia give a national average of 15 to 18 per cent of their weight in sugar. These beets also yield some molasses, and a valuable stock food in the pulp which is dried, kept for a long time, and then shipped long distances.

More sugar plants. The long bean of the honey-locust tree is said to have a higher percentage of sugar than any other plant. Some of the locust beans have been found to contain 29 per cent sugar. They have long been eaten by men and animals because of their sweet taste. No sugar industry based on locust beans has been attempted, although the tree has the great advantage of being able to grow on hilly land without cultivation in most of the tree-producing areas of the United States.

PROBLEMS

Maps. 1. Show the maple sugar-producing areas of the world and some areas which you think might grow maple sugar (Fig. 2-A); the cane sugar-producing areas of the world; the beet sugar-producing areas of the world.

The sugar record. 1. How old is the use of sugar? How common is its use?

2. Briefly trace the early history of sugar and of some sugar plants.

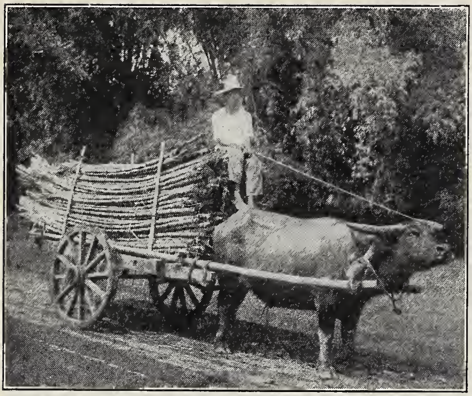


Fig. A. Filipino hauling sugar cane to the mill. Describe the buffalo harness.

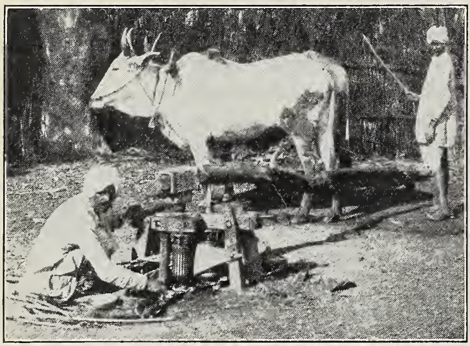


Fig. B. Crushing cane for home use in India, by a method centuries old. It helps to explain the high cost of sugar in George Washington's time.

Fig. C. Boiling sugar for home use in the Philippines. Compare these three pictures with Figures A, B, and C, page 155, and Figure A, page 156.

UNIT 2—THE CANE-SUGAR INDUSTRY

> Two Food Policies. Explain two methods of securing food used in two great sugar islands.

Many crops from one planting. In the frostless tropics a planting of sugar cane will live for many years and produce a crop of stalks each year. It is a most convenient crop for the patch farmer. Grown for home use, sugar cane is to be found beside the grass hut in almost every tropic land where there is enough rain for trees to grow. In villages and towns the children may be seen sucking short pieces of sugar cane (Fig. 154-C) which they can buy much as the American child buys penny candy.

New methods. Science has been applied to sugar production with the result that tractors, fertilizers, new varieties of cane and of machinery have greatly increased the output of sugar. As a result the price of cane sugar has declined so much that sugar is now one of the cheapest foods that we have.

Expensive methods of making sugar are found where mills (Fig. 154-B) with only beasts for power crush a few stalks of cane on a farm. The new methods which have made sugar cheap are found in the great mill equipped with much machinery, where engines of many hundred horse power crush —in some cases—hundreds of thousands of tons of cane a year.

The commercial sugar plantation. The large mill uses much cane, therefore it is necessary to grow cane on a large scale. Miles of sugar-cane fields and the little railroads that run through them are a perfect example of the tropic plantation. These plantations can be developed only where there is fertile, nearly level land, and where the climatic conditions are very favorable for sugar cane. Most of the large plantations are owned by Americans and Europeans.

The sugar-plantation climate. Sugar cane needs warm weather all of the time, much rain most of the time, and a season

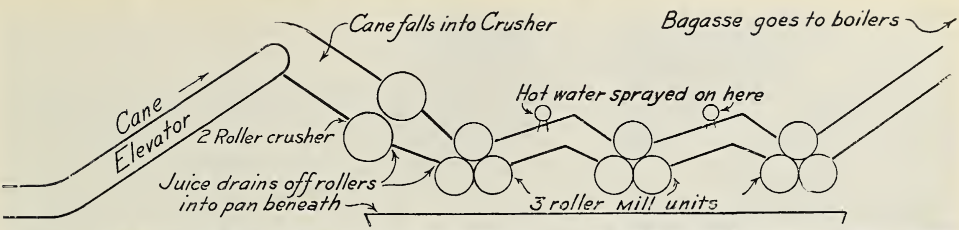


Fig. A. Cross section of cane crushers in plantation sugar mill. It is 265 feet long from left to right and uses 2700 horse power when grinding, at the rate of 4000 tons of cane a day.

that may almost be called a dry season. The sap becomes sugary in the dry season. If instead of the dry season, rain came, the sap would be much poorer in sugar. The regions having a type of climate suited to the development of sugar-cane plantations are far enough away from the Equator to come in the belt having a slight dry season but enough rain to produce forest (Fig. 2-A).

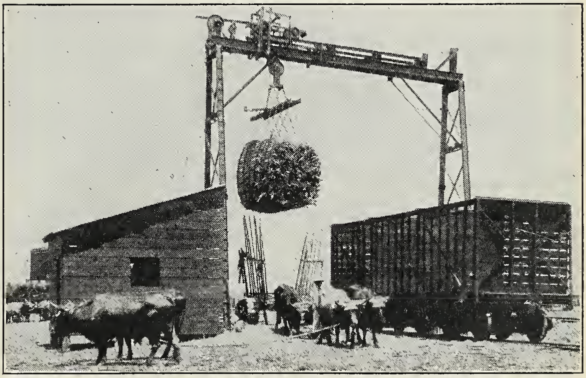


Fig. B. Engine power lifts the load of cane from Cuban-plantation cart to plantation railway. This is one of the ways by which American capital and invention have glutted the sugar market with the cheapest sugar ever seen.

Locate the following sugar-plantation areas: the east coast of Brazil, Mexico, Natal, Egypt, Queensland, India, the coast of Guiana, the West Indies, the East Indies, Hawaii, and the tiny island of Mauritius. In the main, we may say that the trade-wind shore is sugar-plantation land. If sugar is grown farther north, it needs at least eight months' good growing season.

Labor in the cane fields. To plow, to plant, to weed the cane field, and to cut the tall, heavy cane is exhausting work. The white man took Negro slaves to Brazil, the West Indies, the United States, and Mauritius to do this work for him. Nowhere has the white man worked to any extent in the cane fields. After the slaves were freed in the nineteenth century, the low-wage workers from India were taken on contract to Mauritius and Guiana.

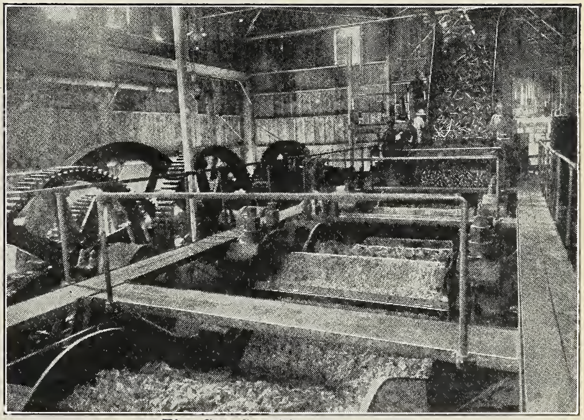


Fig. C. Crushing sugar cane.

Growing cane and exporting sugar. Next to Cuba, India is the greatest cane-sugar producer in the world. There the cane is grown mostly in small plots, and the sugar is seldom refined (Fig. 154-C). In the populous land of India are almost 350,000,000 people. They use all the sugar that India produces and usually import.

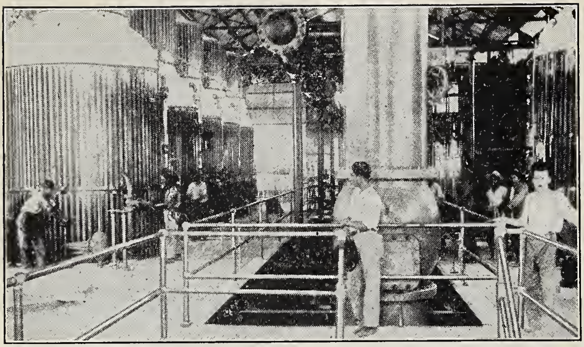


Fig. A. Mass production of sugar. The huge tanks at the left are evaporators in a Cuban factory where steam from engine boilers turns sugar-cane juice and water into sirup, the first process in mechanical mass production in the sugar refinery. Compare with Fig. 154-B.

What countries are the chief cane-sugar exporters (Fig. 158-C)? In comparison with India, Cuba gives a good example of a country with small population being able to export one chief article of food and buy much of the other food she needs. Cuba has almost perfect rainfall conditions for cane and wide plains of rich, level or gently rolling limestone soil which suits sugar. American capitalists have gone there, laid out great plantations, and built fine sugar mills. The mills are situated only a few miles from the ports along the north coast. From the sugar mills of Cuba ships take the sacks of raw brown sugar and in a few days carry them to the huge refineries on the water fronts of New Orleans, Savannah, Baltimore, Philadelphia, New York, and Boston.

Puerto Rico has an important sugar industry which greatly resembles that of Cuba except that it is smaller.

Cane growing in Java. In most tropic countries the cane plant lives for many years and is cut for several crops. In Java only one crop is cut, because the government controls industry and sees to it that the cane field is quickly plowed and that rice is planted there. Rice is needed as food for the large population of this island with its remarkable tropic agriculture.

Cane sugar in the United States. There are a number of cane-sugar plantations in southern Louisiana on the rich soil made of Mississippi River mud, and in southern Texas. Cane growing was recently started in Florida. Unfortunately, our growing season is not long enough to produce cane so well as that of Cuba and other tropic countries.

By-products. The juice of the cane which contains the sugar is boiled. As the water leaves and the juice gets thicker and thicker, most of the sugar settles as crystals of brown sugar, which must be further refined. Some sugar will not crystallize but remains as molasses. Some molasses is used for human food, some for stock food, and some for alcohol of several kinds.

Bagasse, the remains of the cane after it is crushed, is used for sugar-mill boiler fuel and to make celotex, an insulating fiberboard used in building.

The World War and the glut in sugar. The World War (1914-18) cut off trade from European beet-sugar regions. The price of sugar rose several hundred per cent. Stimulated by very high prices, sugar growers made too many new plantations. After the war the sugar-beet industry of Europe was revived and the price of sugar fell below the cost of production. In 1932 seven nations made agreement to limit the crop and the export.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. 1. Are the farming systems of Cuba and Java alike? 2. Explain the connection between the World War and sugar prices.

Do you know the answers? 1. How common is sugar cane in the tropics? Why?

2. Compare the food value of sugar and some other foods.

3. What effect has science had upon the cane-sugar industry? Why?

4. Where are the large sugar-cane plantations found? Why? Who owns them?

5. Who does the work in the cane fields? Why?

6. Do all cane sugar-producing countries produce enough for their own use? (See *Yearbook, United States Department of Agriculture.*)

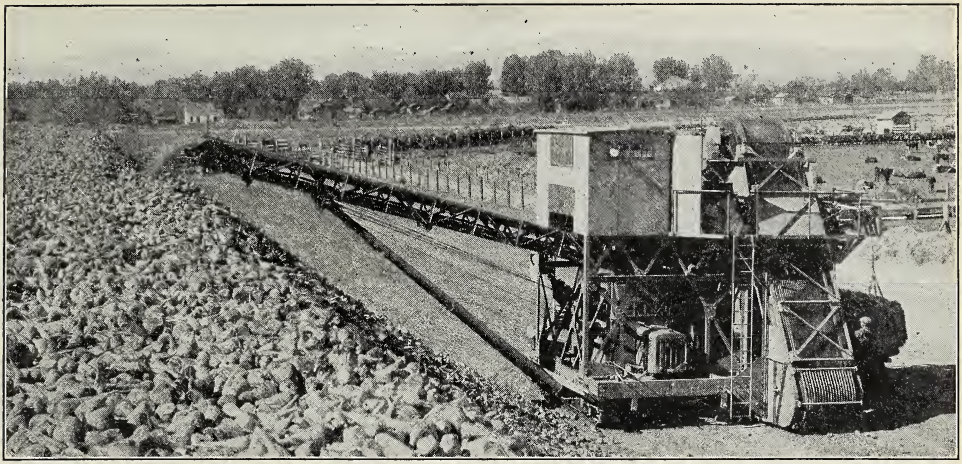


Fig. A. Mass production of beet sugar. This Colorado beet piler unloads a wagon in two minutes, puts the beets on the pile, and returns the dirt to the wagon. In cold weather, beets keep for weeks in the pile waiting for their turn at the refinery. The cattle feed on beet pulp.

UNIT 3—BEET SUGAR

> PROBLEM. See whether it is good business for some European countries to sell sugar at cost.

Climate and location. The maps of corn and beet-sugar production (Figs. 87-A and 158-B) show that corn and sugar beets are not intimate friends in the field. Corn thrives best in hot weather, hot even at night, while the sugar beet if it does not have a summer average temperature of about 70° F. will not make much sugar. See the list of American states producing beet sugar: California, with cool nights because the air is dry; Utah, Idaho, Colorado, Nebraska, Wyoming, and Montana, cool because they are on a high plateau; Michigan so cooled by the Lakes as to be in the small-grain and potato belt.

Intensive agriculture. To produce the sugar beet requires intensive agriculture—much labor and expense on little land. Therefore, the industry is much better suited to Europe than to the United States. Like the cane-sugar industry, it would not be here but for a protective tariff. Nor would it be in Europe but for the fact that tariffs prevent the people from buying cane sugar as cheaply as they might. The soil, which must be fertile, deep, and friable (easily broken), must be deeply plowed, finely prepared, and thoroughly fertilized. The little beet plants are so small and weak that they must be weeded by hand at first, then cultivated as corn or potatoes are cultivated. Much labor is necessary in picking up the many tons of beets and hauling them to the factory. Careful cost figures kept in Colorado, for the seven years before the depression of 1929, showed that the cost of producing an acre of beets was $88.35. But the beet gives a large return—nearly two tons of actual sugar an acre. Beet tops and pulp furnish good food for dairy cattle. The fertilizer left in the ground and the working of the soil that was necessary to prepare for beets almost guarantee that the beet crop will be followed by a splendid crop of grain or grass.

So thoroughly is the beet a crop of the intensive type of agriculture that it is the only field crop in which the American yield is as great as that of Europe. As with cane, a large acreage is required to keep the factory running. To guarantee this it is a common practice for the manufacturer to have farmers grow a given number of acres of beets on contract. Most of the beet

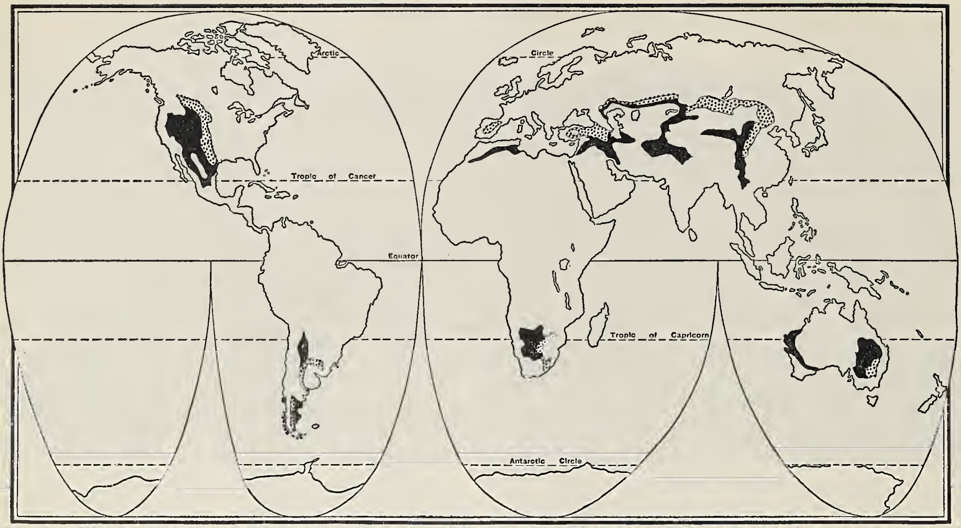


Fig. A. The temperate-grassland climatic regions of the world. The areas with black dots have more rain and better grass than the solid black areas.

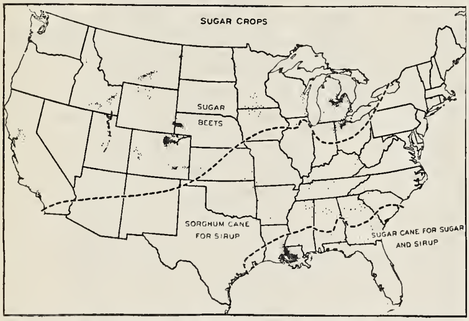


Fig. B. Production of sugar cane, sorghum cane, and sugar beets in the United States. Each dot represents 1000 acres planted to sugar cane, sorghum cane, or sugar beets.

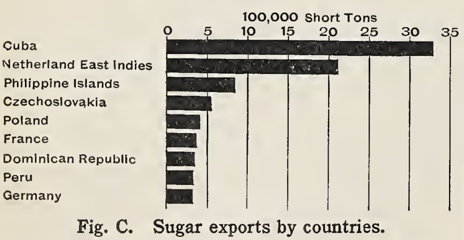


Fig. C. Sugar exports by countries.

sugar grown in the United States is refined in the factory to which the beets go. The sugar and its by-products are used in the near-by parts of the country.

Importance of the sugar beet in Europe. All these facts show how admirably the beet crop fits the intensive agriculture of north central Europe, with its heavy population, small farms, great need for food, and large number of farm animals. The beet-sugar belt begins in northern France and extends through Belgium, the Netherlands, Germany, Czechoslŏvakia, and Poland to southern Russia and Hungary.

Sugar-beet growing gives so much work and supports so many people that several European countries are willing to export sugar at cost, and some have even paid bounties to their people who exported sugar.

The sugar price. The great supply of sugar in 1930-34 was one of the puzzling things to the nations that exported it. The price was so low that thousands of people in Puerto Rico and elsewhere could not get money to buy enough food to be well nourished.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. What is the answer to the problem at the beginning of this unit? Give as many

reasons as you can why a farmer might wish to grow sugar beets.

Placing the industry. 1. Compare the climatic requirements for sugar beets, corn, and sugar cane.

2. To produce sugar beets ——— agriculture is required. Tell why. Does any picture help to prove it?

3. Why isn't the sugar beet grown extensively in the Southern Hemisphere? See Figures 26-A and 27-A and study temperatures of warmest month.

Fig. A. A field of sugar beets in Idaho. What are the men doing?

CHAPTER SUMMARY

The sugar situation. 1. How long would it take two-ton truck loads of sugar, traveling at ten a minute past your school, to carry the amount of the American import for a year?

2. Make a list of foods containing sugar that you like to eat.

3. Does the same farmer grow any two kinds of sugar? Explain.

4. What does Figure 158-C tell you? Make a similar graph for the latest year (*Yearbook*).

Interesting but difficult debates. 1. Resolved: That sugar is more valuable to mankind than coffee. (See book by Rose, M. S., *Feeding the Family*.)

2. Resolved: That cane sugar is more valuable than beet sugar.

3. Resolved: That man should eat less sugar.

4. Look at pictures of cane crushing and boiling sugar-cane juice and make talks on "the old and the new" or "commercial agriculture" or "mass production" or "glutted markets."

Extra credit. 1. See if you can find enough facts in the table of food values (page 373) and in the *Yearbook, United States Department of Agriculture*, to figure out the food yield per acre of sugar beets, sugar cane, wheat, corn, potatoes.

2. Find out the success of the Chadbourne International Sugar-Limitation Agreement.

3. Has sugar been a help or a hindrance to the people of Puerto Rico? Explain.

Writing questions. Write a dozen or so multiple-choice questions about the facts in this unit. One such question might be

Most of the sugar used in the United States comes from:

(1) *beets* (2) *cane* (3) *sorghum* (4) *maple trees*

Exchange your papers with a classmate and underscore the correct answer to each question.

Fig. B. Spading up the earth instead of plowing, near Metz, France. Thousands of acres of good plow land in Europe and much more in China, Japan, and India are worked in this way. Compare Figure 58-A and Figure 91-A.

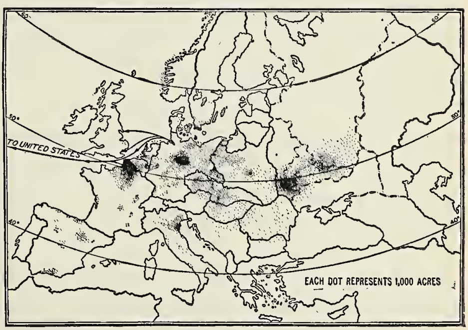


Fig. C. Acreage of sugar beets in Europe.

Circular graph. Using the data in Table 47 (page 362) make a circular graph (Fig. 87-B) showing the leading producers of sugar in 1930-31; in 1932-33.

Fig. A. A rubber plantation in Sumatra owned and operated by an American company. The banks and pits prevent any loss of water by running away or loss of soil by erosion. These "silt pits" are a great invention.

CHAPTER XIV
RUBBER
UNIT 1—AN INDUSTRIAL REVOLUTION

> Creating Industries. How can man use plants to create new sources of wealth?

The early uses of rubber. Columbus, on his second trip to the New World, is said to have found natives in Haiti playing games with rubber balls. The Europeans found that balls like those the Indians played with would rub out pencil marks. Hence the name India rubber.

Rubber is made of dried latex, a milky looking substance produced within the bark of several species of trees. The natives of Mexico smeared cloth with latex. When this dried, it made the cloth waterproof.

For a long time rubber was used but very little. But in the last decade of the eighteenth century, experimenters in England and the United States laid thin layers of rubber on cloth to make it waterproof. They also used rubber in making garden hose, which had previously been made of leather. Some years later sulphur was mixed with rubber. The resulting product was much tougher than pure rubber and did not become sticky in hot weather. This made possible many new uses. Since that time improvements have been rapid, until now we are said to have 30,000 different articles manufactured from rubber in the United States. The most important, of course, is the amazingly tough automobile tire.

The pneumatic tire. The pneumatic tire, invented about 1890 for bicycles, and for automobiles shortly thereafter, caused a revolution in the use and production of rubber. Until that invention was made, the wild trees furnished all the rubber needed. The chief source of supply was the Amazon Valley, although some came from the tropic forests of Africa and Central America.

Rubber scarcity. The automobile sent the price of rubber skyrocketing. The rubber hunters enjoyed new riches and

hunted new forests. Rubber came from an increasing area in the Amazon Valley, from Central America, Mexico, and from Africa, where there are many species of rubber-yielding vines. The price still rose and there was prospect of a rubber famine. Capitalists turned to the simple device of planting orchards of the rubber trees. The Brazilian rubber tree (*hevea*) was found to grow well in southeastern Asia, where laborers were plentiful, and there was great speculation in rubber plantations.

Someone found that a little desert shrub, called the *guayule*, growing in the arid part of the Mexican plateau and adjacent parts of New Mexico, Arizona, and Texas, also yielded rubber when ground and treated in a factory. In 1910, when the rubber plantations were yielding 8200 tons of rubber, guayule produced 5000 tons. It no longer comes to market, although the Russians have started planting guayule and three other kinds of rubber plants in Central Asia so that they may have a rubber supply without exporting something to pay for it.

The rubber plantation. To start this simple enterprise one needs only to cut down the forest in a region where soil and climate suit rubber, plant rubber trees and keep other trees from crowding them. Such places are to be found in many islands and four continents.

The cheapness of the labor of coolies on contract from China, Java, and India caused enterprising men to start rubber plantations in the wide forested plains of Sumatra, Java, the Malay Peninsula, and also in Ceylon. These plantations, owned chiefly by British, Dutch, and Chinese, yielded the owners large dividends at first. In recent years American rubber-manufacturing companies have also set out plantations.

Does the table on page 363 indicate the success of the rubber plantations? By 1920 the supply of rubber was so great that it cost more to grow a pound of rubber than it would bring in the market.

A price agreement and a rubber hunt. The British growers of the Far East formed

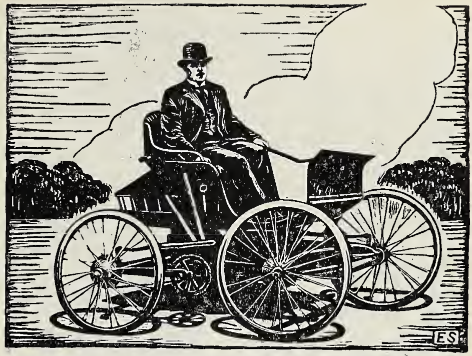


Fig. A. The first automobile in America.

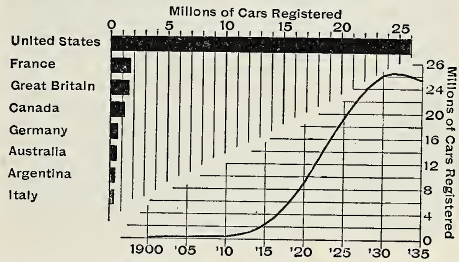


Fig. B. This graph shows two sets of facts: the number of automobiles registered in eight leading countries; the number of cars registered in the United States from 1900 to 1935 (Est.). ¶ What connection do you see between the two illustrations on this page and the plantation scene on page 160?

a price-fixing rubber trust, so that they could get a profitable price. Because of the high prices which resulted, the Americans began to hunt the world over for an independent source of rubber. Thomas A. Edison examined 14,000 plants to see if any contained rubber. He found that 1240 of them did, 600 of them in promising quantity. Mr. Edison finally settled upon the goldenrod as the most likely plant—not that it contained a great deal of rubber within, but the plant was "sowable and mowable," and could be handled like wheat or hay. Therefore, he started breeding goldenrod plants to improve the rubber content, expecting them eventually to yield 150 pounds of good rubber to the acre. In 1934, the Edison Botanic Research Corporation was continuing the experiments.

The Russians report new rubber-yielding plants in Central Asia.

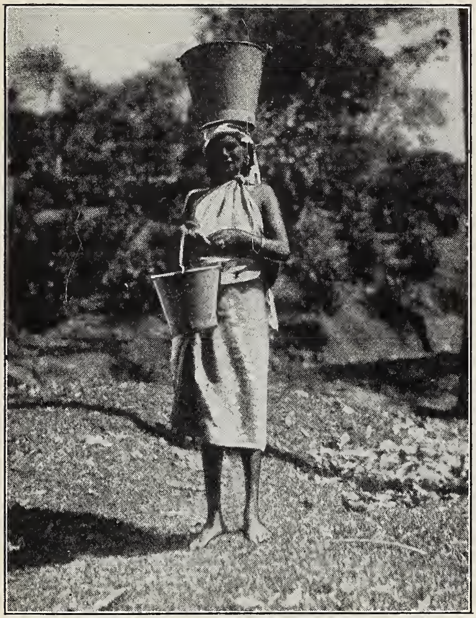


Fig. A. Indian contract laborer carrying a bucket of latex on a Ceylonese rubber plantation. She earns fifteen cents a day.

Rubber planting in Africa and Amazonia. At the same time an American tire manufacturer started large rubber plantations in Liberia, an American automobile manufacturer did likewise on the great concessions of land he received from the Brazilian Government on the Tapajóz, a branch of the Amazon.

Progress in the Far East. Meanwhile, until these new plantations are old enough to come into heavy bearing, the Eastern rubber growers continue to supply the market.

In June, 1933, an expert of one of the great rubber companies reported that they were paying men on their Sumatra plantation 16 cents American money a day; women, 14 cents. He also said that ordinary rubber plantations were yielding 450 to 500 pounds an acre a year, but that budded trees of improved and carefully selected varieties were yielding 2500 pounds an acre, and that they expected to deliver rubber at New York for 3½ cents a pound and make a profit.

A small proportion of the latex is shipped in tank cars in Malaya and in tanks on steamers to the United States. It finds a large and increasing number of uses in industry.

Synthetic rubber. For years rubber has been made in laboratories from coal, petroleum, and limestone, but thus far it costs much more than that obtained from trees.

Science, resources, and new industries. The rapid increase in the yield of rubber by finding or breeding very productive trees and making whole plantations like them, is only a sample. There are scores, perhaps hundreds, of productive trees in the tropic forests and in the forests of our own country that await such intelligent treatment. See Chapters XI and XV.

THINGS TO DO AND QUESTIONS TO ANSWER

Maps. 1. Make a map showing the chief rubber-producing areas of the world.

2. Make a map showing the chief rubber-consuming areas of the world.

What the facts show. 1. Examine carefully the illustrations in this chapter and in the chapter on the "Future of Farming" and then make a talk on "conservation of the soil."

2. Make graphs (page 161) showing: (a) leading rubber importers; (b) the production for a period of years. Make one graph with two lines showing "b," and registration of automobiles in United States, 1900–30 (Fig. 161-B).

3. Suppose the Pygmies mentioned in the Introduction (pages 1-6) should work on a rubber plantation. Tell the influence it would have on trade.

Questions requiring careful thought. 1. Plant breeding depends upon the fact that a hundred plants grown from the seed of one plant will differ from one another. How has this fact been applied to sugar and rubber to make new industries? Look again at Figure 127-A.

2. Make a list of articles that have rubber in them.

3. What difference would it make to world trade if the rubber-plantation workers got five times as much wage per day?

Interesting debates. 1. Resolved: That rubber is more valuable to mankind than is coffee; than is sugar; than is gold.

2. Resolved: That rubber is more valuable to mankind than corn.

Fig. A. At the left is one of the great landscapes of the world. The coconut trees overhanging the sand and the surf are to be found on the tropic shores of almost every continent and every tropic isle. At the right a native of Ceylon "shinnies" up the trunk of a towering palm to reach a coconut

CHAPTER XV

NUTS

Many wild nuts. The food we call nuts is produced by many varieties of trees. Nuts provide food to start the young tree into growth. Many kinds of nuts in every continent have been eaten for a very long time by animals and man. A few nuts have become articles of modern commerce.

UNIT 1—TROPIC NUTS AND NUT TREES

> PROBLEM. How might the governor of a colony in a tropic forest region make good use of a fund for industrial improvement?

Many productive trees. The tropic forest has an abundance of nut-yielding trees. Many of their products are unknown to us, but several have already become very important in foreign trade.

The coconut. The coconut is the greatest nut treasure of the tropics. This wonderful food, protected by a thick and buoyant husk, will float for months in the water. When thrown upon some shore of the tropic sea, it will grow and the tree will yield a rich harvest where its roots have nothing but the sand of the beach in which to feed (Fig. 163-A). Therefore, the coconut palm has spread to every continent having tropic shores. It overhangs the sand and surf along thousands of miles of tropic seashore. That beach is one of the great sights of the earth.

Constant harvest. The extraordinary coconut tree has blossoms, little nuts, and big nuts all at the same time. It yields ripe nuts every month of the year. A tree yields from 20 to 300 nuts a year. Some plantation trees in Mindanao average 200 nuts each year. The unripe nut is filled with a refreshing liquid. The ripe nut, which will keep for months, is a rich food. The coconut has been used by man as food in many lands in many ways for many ages (page 373). Indeed, the peoples of some of the small Polynesian islands meet nearly all their needs from coconut trees, coconuts, and fish.

Coconuts in modern commerce. Besides having been of great use to primitive man, the coconut tree now furnishes the world market with staple articles that are handled by the shipload. The excellence of the coconuts for food and as raw material for manufacture causes the people of the United States to import coconuts by the million as fresh nuts, and also as flaked and dried coconut, which can be bought in packages. But these are minor uses in comparison with the oil. We import thousands of tons of coconut oil and of copra, the dried meats from which oil is crushed.

Fig. A. This coconut-palm tree with its heavy burden helps to prove the statement that the tree is one of nature's engines of production. What is the meaning of the saying "When his coconut trees come into bearing, he hangs up his hammock"?

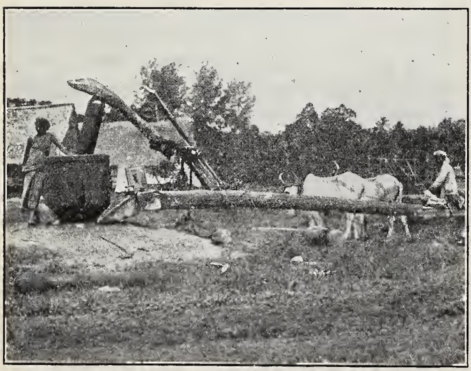


Fig. B. Crushing coconuts to get the oil in the Malay States. Do you think they get all the oil?

Coconut oil is used in making soap, and chemists have learned how to purify and flavor the oil so that it now comes to the tables of Europe and America as a base for cooking fats and for margarine, a substitute for butter. Thus the coconut tree from the shore of the tropic sea has reduced the demand for lard and butter in the markets of the corn belts and dairy belts of both the Northern and Southern Hemispheres.

Good keeping qualities of coconuts. The coconut differs from many tropic products in its keeping qualities. The nut may lie in good condition on the ground for months during a dry season. When the nut has been opened and its meat dried in the sun, the product is called *copra*. Copra will keep for many more months before being crushed to make oil. There are 1300 pounds of oil to a ton of copra.

We import great quantities of coconut products from the Philippine Islands, not because this is a better coconut land than many other tropic localities, but because there is a lower tariff on produce from the Philippines than from other countries.

The oil palm. In recent years a rival of the coconut tree, as a producer of oil for soap and food, has appeared. It is the oil palm, whose fruit and kernel yield much oil. In structure its fruit is like a peach with oily flesh and oil in the kernel of its seed. The oil palm grows wild in the equatorial forests of Africa. The industry could be introduced easily into the American tropics just as the hevea rubber tree has been taken from America to the Eastern tropics. For this reason we may expect the oil-palm industry to spread rapidly into many tropic-forest regions. Other palms yielding nuts that produce excellent oil already exist in the tropic forests of Brazil and in Sumatra.

The Brazil nut. This nut, which finds its way into so many million American Christmas stockings, is the produce of a tree native in the Amazon forests. This tree also might be introduced easily into the Eastern Hemisphere. One needs to venture with great caution under the Brazil-nut tree. If the tree happens to drop one of its two- or three-pound fruits (Fig. 165-C) upon a man's head, he may never return.

Fig. A. The very fruitful corozo or tagua palm, sometimes called ivory-nut palm. Can you tell why?

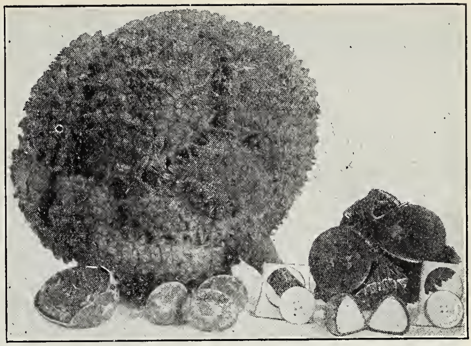


Fig. B. Close-up of ivory nut and fruit, showing the various stages in making buttons.

Fig. C. The picture is less than half the actual size of this hard shell—the shell in which a dozen or more Brazil nuts grow. This is one of the many free foods produced by nature and mostly wasted in the tropic forest.

Tagua nuts or corozo nuts. The tagua palm has a fruit which, in its green stage, is eagerly eaten by pigs and other animals, and, when finally ripe, has seeds so hard that they are used as a substitute for ivory in making buttons. A few thousand tons are imported each year into the United States and Europe, chiefly from Ecuador, Peru, Colombia, and Panama, where the tree grows wild in moist forests. Tagua nuts are also exported from East Africa, the Sudan, the Philippines, and Australia. In parts of the Sudan the natives pick up tagua nuts and sell them in years when the grain crop is short and they need a little money.

Possibilities of tropic-nut industries. As is the case with tropic fruits (page 139), there are many other tropic nuts producing oil or food, or both, of which we know nothing in this country. The need or market for them has not been developed. The plantations of coconut palms and oil palms are usually nothing but natural forests with rival trees kept out. Many more species of nut trees might have similar simple culture. As an example of this creation of new wealth, some enterprising Dutch agriculturists have begun to do the same thing with the African nut palm that has been done with rubber. They have set out large plantations of the palm trees in Sumatra, and we may soon have a surplus of oil as we have had of sugar.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. What is the answer to the question at the beginning of this unit? Does it have an answer for the United States also?

A map. Color a map of the world showing where it is supposed tropic-nut trees would grow.

What is the important idea? 1. Tell the story of as many different tropic-nut trees as you can; of as many products as you can.

2. Tell something about the food value of nuts; about the tree that may bombard you.

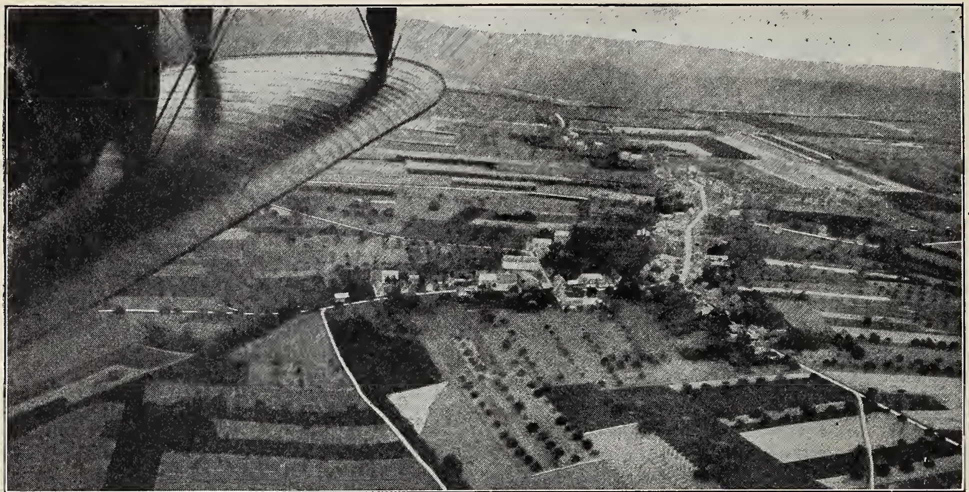


Fig. A. A French village between Étaples and Paris, showing farming districts. Most of the trees are either nut trees or fruit trees. Thousands of Persian walnut trees are scattered in the fields of France and Switzerland.

UNIT 2—NUTS AND NUT TREES OF THE TEMPERATE ZONES

Scientific Work. Take the pecan industry as a type and plan some scientific work that should be done.

Mast and acorn bread. The forests in the frost lands are also rich in nut-bearing trees, but many of the nuts are small. Under the name of *mast*, acorns, chestnuts, and beechnuts have fed squirrels, opossums, raccoons, turkeys, wild pigs, primitive man, and more recently, the domestic pig. The acorn has probably been one of the great foods of the human race. (What is its food value?) It was an important breadstuff in two or three continents, and probably supplied this need of man for a very long time before he grew wheat. (See the book *Tree Crops*, by J. Russell Smith.)

The Persian walnut. The walnut family has many members. The best known is the Persian (English) walnut. This nut, sold nearly everywhere in our stores, is probably a native of Persia. From Persia it has traveled completely around the world. I have seen Persian walnuts growing in Japan, Chosen (Korea), China, the Himalayan slopes and valleys, Persia, Palestine, Syria, Asia Minor, Bulgaria, Yugoslavia, Italy, Switzerland, France, Spain, North Africa, Germany, England, Scotland, eastern United States, Ontario, and our Pacific coast. The great ruins of the ancient city of Baalbec in Syria are partly shaded by magnificent Persian walnut trees. This nut has also become a crop in the Southern Hemisphere.

While this tree grows to some extent in climates of humid summer, it thrives better in the Mediterranean type of climate. Can you prove or disprove this statement from the statistics of production? When California introduced the fruits and other Mediterranean crops, she took also the Persian walnut. The growing of walnuts soon became an important orchard industry. California furnishes almost all the walnuts grown commercially in the United States, although there are also thousands of trees scattered over many Eastern States.

The American black walnut. This tree of dignity and beauty, fine wood and good nuts, grows wild over one third of the United States. Unlike most nuts, the black walnut keeps its excellent flavor after being cooked. This species, which yields a

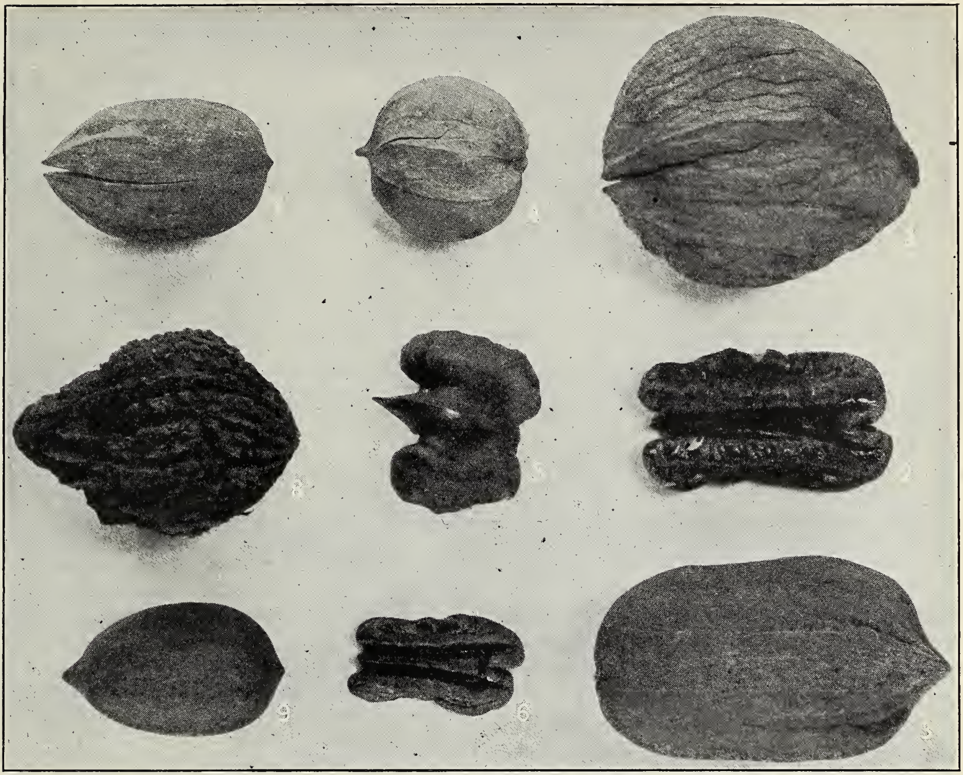


Fig. A. Some nuts that Nature has produced in America. By scientific plant breeding, man can probably do much better. 1, Thick-shelled western shellbark; 6 and 9, meat and nut of a fine Illinois pecan. You can crack it in your fingers; 2 and 3, a natural hybrid nut, cross of 1 and 9; 5 and 8, meat and nut of an extra-fine, thin-shelled American black walnut; 4 and 7 are other natural hybrid hickory nuts that yield kernels in complete halves. These hybrids are from parents selected by Nature's chance, not by man's intelligence.

large crop, is just in the beginning of commercial production. Good varieties have been found and a few orchards have been planted.

The pecan. The hickory group of the walnut family, like the walnut group, has many species. Their very nutritious nuts were used by the American Indians for food. Most hickory nuts are small and the kernels can be secured only in small pieces. But one species—the pecan—was early found to produce here and there a few trees with large nuts, thin shells, and kernels that could be secured in entire halves or even as "wholes." By budding and grafting, orchards of these very fine varieties are being grown in Georgia, Florida, Louisiana, Texas, and other parts of the South, and in Indiana, although two thirds of the crop is still produced by wild trees.

In time, orchards of trees from other members of the hickory group will be planted. They, too, have rare trees yielding nuts with thin shells and kernels that can be obtained easily.

The chestnut. The useful chestnut tree also has several species and will grow over as wide a territory as does the walnut. It will produce more bushels of nuts an acre than any frost-land nut tree with the possible exception of the oak. For more than a thousand years orchards of grafted chestnut trees have been growing on moun-

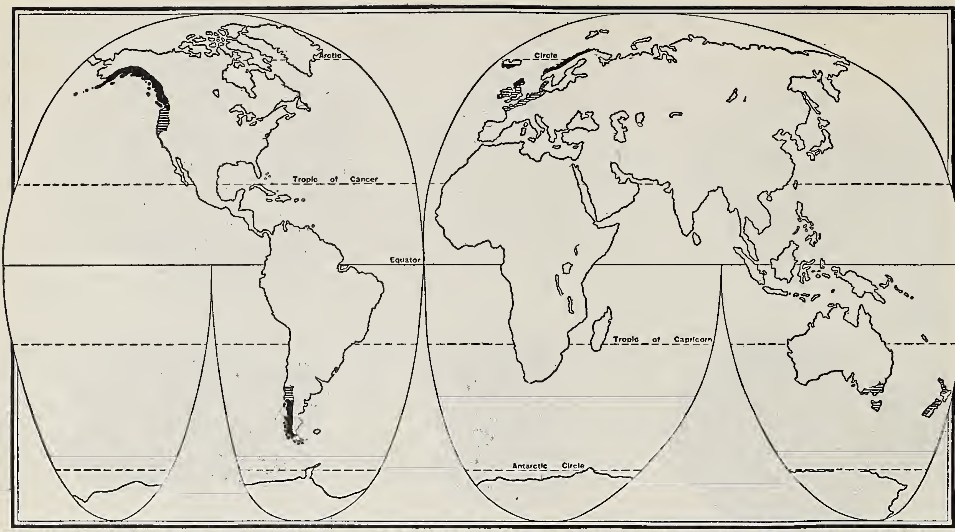


Fig. A. Cool, moist, west-coast climate regions of the world. See these regions also in Figure 2-A. The black areas have a summer too cool for trees or grain; the shaded areas have a warmer summer and can grow forests, potatoes, oats, and barley.

tain sides in Italy, Spain, Sardinia, Corsica, and southern France. Imported chestnuts are for sale in the autumn in hundreds of American stores.

European mountain farmers use the chestnut for their own food and as food for domestic animals, just as corn is used for food for mountain peoples and animals in many parts of Appalachia, Mexico, and the Andean countries. While soil from the hill lands of Appalachia washes away after a few crops of corn, the chestnut orchards of the European mountains have stood with their soil intact since the days when Roman soldiers rested in their shade and ate sweet nuts.

THINGS TO DO AND QUESTIONS TO ANSWER

Problem. Solve the problem suggested at the beginning of this unit. What might be the benefits? Who would be benefited?

Map. Make a map showing with crosses the places where I have seen the Persian walnut growing. Shade the areas where you think the pecan might grow.

Facts that suggest something. 1. What is the food value of acorns and other Temperate Zone nuts (page 373)?

2. What service did the acorn render before man grew wheat?

3. The state of ——— furnishes almost all of the ——— grown commercially in the United States. Show on a map of the world other places having the same climate.

4. Have nuts been of equal importance to man at all times?

5. Why has the chestnut been so valuable to mountain farmers in Europe? Explain.

CHAPTER SUMMARY

Some difficult problems and projects. 1. Make a list of nuts you have eaten. Where do you think they came from?

2. Give a talk on:

(a) Nut trees and the conservation of the soil.
(b) Nut trees and future food supply.
(c) The food value of nuts, of fruits, of vegetables. Do you think a monkey in a tropic forest is well fed? If you had to stop eating meat, what would you eat in its place?

3. Examine the picture of the French villages and fields. Look at the pictures in chapters you have already studied and make a talk about:

(a) Nut growing in France and in California.
(b) Large-scale and small-scale agriculture.
(c) The amount of farm crops one man's labor will produce in ——— and in ———.

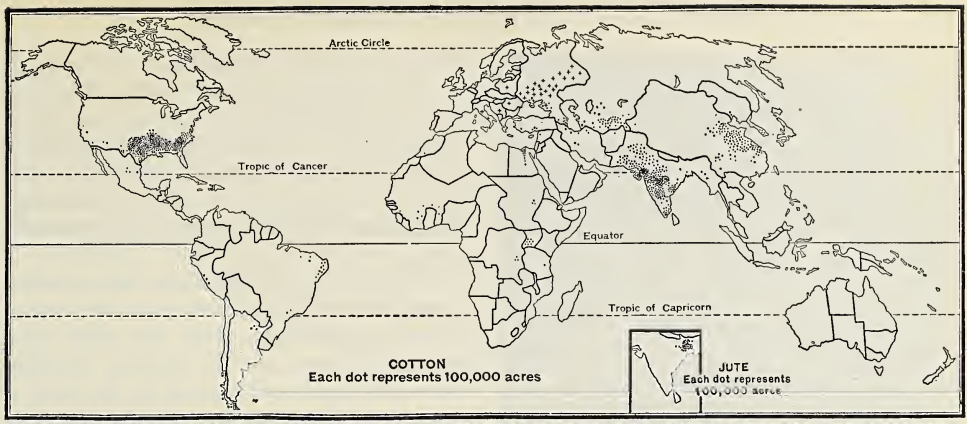


Fig. A. Each dot on this map represents 100,000 acres planted to cotton. Decide from the map which countries are the largest cotton producers. The small insert of India shows where jute is produced.

CHAPTER XVI

VEGETABLE FIBERS, SILK, AND RAYON

UNIT 1—CLOTH AND PLANT-STALK FIBERS

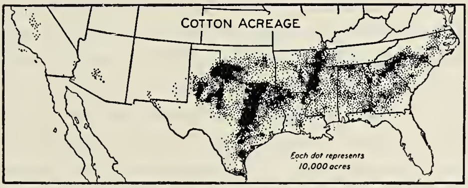


Fig. B. Cotton in the United States. How many acres of cotton are represented by each dot? As this map is on a larger scale, it can show much greater detail than can Figure A.

> PLANTS TALKING. Imagine a conversation in which several fiber plants tell how useful they are or might be to man.

A buried museum. A very long time ago the people of Switzerland lived in villages where the houses were built upon the tops of poles that stood in the water near the shores of lakes. The people lived thus because they could protect themselves better from their enemies. These old Swiss villages have proved to be of great interest to us. These early peoples lost various articles by letting them fall into the water. Today we dig through to the remains of these lake dwellings. It is almost like finding a buried museum. Pieces of linen fishing lines, bits of linen cloth, and many other articles have been dug up. Having been preserved in mud for thousands of years, these things remain to tell us of the past.

Many useful fibers. These lake remains prove that a long time ago men found that the fibers of plants could be twisted together to make string, and that strings could be woven to make cloth. This was a very great discovery in the progress of the race. It gave the human family something to wear besides their own skins, the skins of animals, and the stringy bark of certain trees.

The art of making cloth was known in many parts of the world at an early date. Before the time of Columbus the Peruvians made a cloth exceeding in fineness any cloth that is now woven.

Fibers are a part of the structure of many plants. Certain fibers are found in the bark and stalks of plants, such as flax, jute, hemp, and that member of the banana family which yields abaca or Manila hemp. Other plants, such as henequen and sisal, have fibers in their long, thick, fleshy leaves. In wood there are short fibers

Fig. A. Woman in Sweden splitting flax, one of the old, old processes of getting the fiber from the stalk.

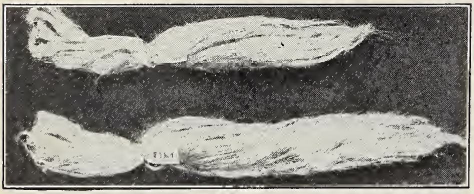


Fig. B. Flax fiber. In ten years, by selecting the best each year, a new variety was produced yielding one third more fiber than the parent (top). The two grew in the same field. Name some other plants that might be benefited by the process of *selection.*

Fig. C. Abaca plants. The wind has broken most of the leaves. The fiber comes from the leaf stems—from ground to leaf. Pineapple plants in background.

which, when separated and again brought together in a certain way, make paper.

Flax and linen. The fishing line and the linen cloth found in the buried lake village were made, like all linen goods, from the fibers taken from the stems of the flax plant. The botanical name for flax means "most useful." Men began to cultivate an annual flax plant in Mesopotamia and Egypt thousands of years ago. Now some flax plants still grow wild in southwestern Asia.

From the time of the Swiss lake dwellers to the time of Christ, and on to the time of George Washington, linen and wool were the chief fibers used in making clothing. For many ages, and almost to the time of Columbus, Egyptian flax was the best flax known. Five thousand years ago Egyptian mummies were carefully wrapped in linen made from flax. Flax was carried from Egypt to all the trading countries of Europe.

Growing commercial flax and hemp. The flax plant grown for fiber needs a cool, moist summer. In the United States it is grown only in the Willamette Valley of Oregon. What other parts of the world have a similar type of climate (Fig. 2-A)? Some flax of very fine quality is grown in cool, moist Ireland, a little is grown in northern Japan, but the greater part of the crop comes from countries along the shores of the Baltic Sea.

Before cotton came into use, fine cloth, lace, and embroidery were made of linen, while the coarser fiber of hemp was used for rougher products, such as rope, sacking, canvas, and the coarse clothing of workmen. The ships in which colonial New Englanders fished and sailed the seas had rigging made of hemp. But hemp sinks in water, and has to be tarred to make it waterproof. Therefore hemp has given way to the superior rope made of abaca or Manila hemp (page 171).

Hemp will grow in hot India and cool north Russia, but it must have a deep, rich soil to make a long stalk that will yield much fiber. A few fields of hemp are grown in Kentucky and Wisconsin, but most of the world's supply comes from Italy, Rumania, and Yugoslavia, where there is

plenty of cheap labor to do the work of getting the fiber out of the stalks.

Jute. The use of hemp diminished very greatly after Europe and America began to import the still cheaper fiber of the jute plant from India. It is easy to spin the long jute fiber into gunny cloth, the cheapest of all fabrics. The world's supply of sugar, coffee, grain, and wool is shipped in gunny sacks. Gunny cloth is used also for wrapping bales of cotton and other bulky articles.

The jute plant needs at least six months' growing time when the temperature averages above 80° F., which means full tropic climate. It needs lots of rain and rich, well-plowed soil. These conditions exist in the lower valleys of the Ganges and Brahmaputra rivers in India. About 99.7 per cent of the world's crop of jute is grown there.

For some weeks only the tops of a part of the crop show above the flood waters that overflow wide areas of this delta land. The water keeps weeds from growing among the jute plants and gives the ground an annual fertilizing.

Getting fibers out of jute stalks. A great deal of work is required to cut the twelve to fifteen tons of green jute stalks produced on an acre of land, strip off the leaves, rot the stalks in water, strip off bark stalk by stalk, wash the pulp out of it, clean the fiber, and dry it in the sun.

To get the fiber from the jute plants—as well as from flax and hemp—the stalks are first rotted, or *retted*, by soaking them in water for some days or weeks. This sets up fermentation and loosens gummy substances in the plant. These can then be separated from the fiber by washing. Retting requires careful work and excellent judgment. If soaked too long, the fiber is weakened; if not soaked long enough, it is gummy and cannot be worked easily. The cleaned fibers are finally dried in the sun. Calcutta is the leading jute center of the world.

India's cheap labor, alluvial lands, and floods enable her to keep her monopoly of jute, which she sends for manufacture to many countries of western Europe.

Fig. A. Cutting and bundling the leaves of the sisal plant. The plants yield leaves for years. Do you think machinery can cut it?

Fig. B. What differences do you note between these Papua-sisal fibers and cotton (Fig. 173-A)? Find two leaves of the sisal plant.

Abaca, sisal, and henequen. These three plants yield long, strong, whitish fibers which are rivals of hemp. They are useful chiefly for making cordage like binder twine and rope.

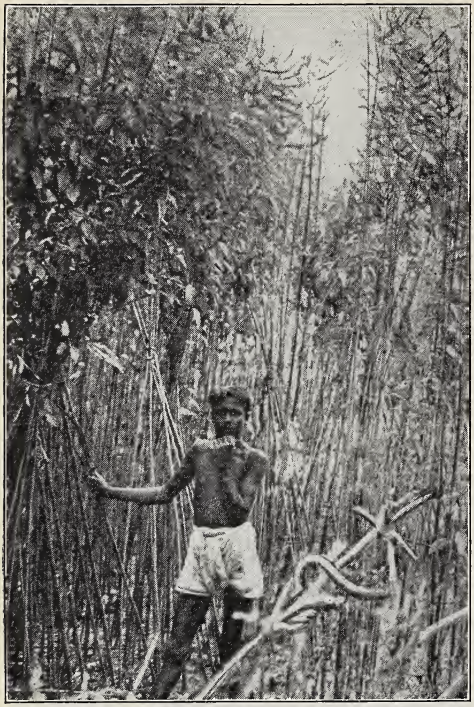


Fig. A. Jute plants and worker near the Ganges River.

Abaca is a fruitless species of the banana family. Its long leaves have pithy stems which yield fiber about ten feet in length. To get the fiber, one erects a little shelter of leaves in the abaca grove, fastens a long knife close to a stick, making an instrument something like a huge pair of scissors. He then draws the abaca stalk between the knife and the stick in such a way that the pulp is stripped off and the fiber is left. Excellent rope and twine are made from abaca. For a long time it was a monopoly of the Philippines, but Sumatra now exports some. Japan uses the finest manila-hemp fiber for making hats.

Henequen and sisal are close cousins and members of the genus *agave* (Fig. 171-A), whose leaves are long, thick, and spiny. Both plants are natives of Yucatan, where there is a large area of rough limestone land with scanty rainfall. The agaves do well in climates too dry for grain, bananas, or rubber.

In eighteen months to three years after it is set out, the sisal plant begins to yield its leaves. This continues for from four to six years, when the plant flowers and dies. Henequen lives longer than sisal and is slower in coming into bearing. Other plants must not be allowed to shade these plants nor must vines be allowed to climb over them. If they are cultivated with plows, the mules wear leather leggings for protection against the spines. In Yucatan much of the land is so rough that cultivation is done with the machete and hoe.

Mass production. Producing agave fiber in commercial quantities is an industry of the machine age. From 100,000 to 200,000 of the big, thick leaves are fed into a machine which throws out twenty to thirty pounds of pulp to one pound of nice white fiber useful for making bagging, rope, and twine. The plantation should be large enough to keep the machine running for at least six months. If it runs the entire year, 3000 to 6000 acres are necessary.

The industry spreads. Since the plants require tropic climate and can stand the drought of a dry season, a large area of land is suitable for the introduction of the agaves. Already large plantations of sisal have been established in Kenya, Tanganyika, Mozambique, Senegal, Dahomey, Sumatra, Java, India, and Haiti. The slower henequen has been introduced only into Puerto Rico, Jamaica, and tropic East Africa.

THINGS TO DO AND QUESTIONS TO ANSWER

Did this unit tell you: 1. How long ago man began using flax to make cloth?

2. From what plant fiber linen is made? the climate this plant likes?

3. Where flax is grown in the United States? why it is grown there?

4. What commodities are made from hemp; from abaca; from jute?

5. Why India is the greatest jute producer in the world?

A picture hunt. Find pictures of plants mentioned in this unit. Make a bulletin-board display.

For extra credit. Choose a fibrous plant from this unit. Get material to prepare a report for class.

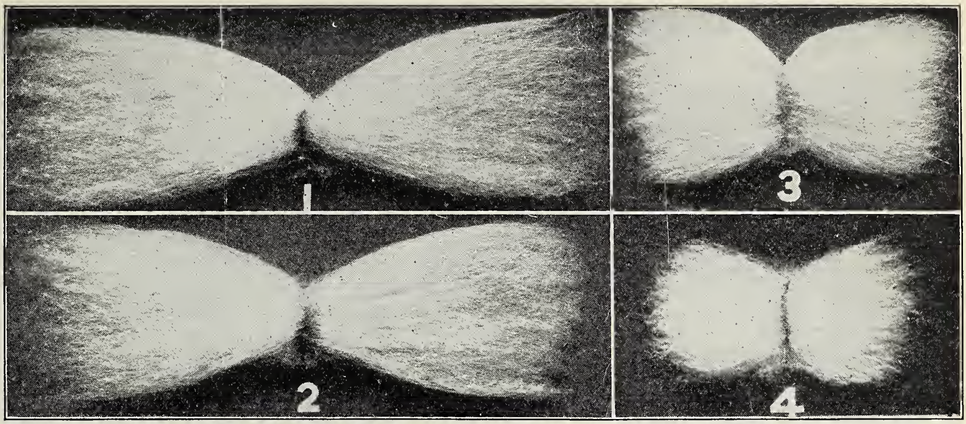


Fig. A. Cotton fibers, natural size, attached to seed: (1) Sea-island cotton; (2) Egyptian cotton, much used for automobile tires; (3) Texas cotton, used for cotton clothing; (4) Indian cotton, used in India, Japan, and Europe for clothing.

UNIT 2—COTTON—A SEED FIBER

A REVOLUTION. King Cotton says, "I made a revolution." What does he mean by it?

Results of an invention. There was a time when many people in the Southern States sat all day long, picking cottonseed out of the cotton. Each person could pick only about two pounds of cotton in a whole day. Then one day a young man named Eli Whitney had an idea. He made a simple invention which revolutionized the world's trade in fibers and the material for man's clothing in all continents. Young Whitney made a machine with two working parts, one having teeth like a comb, the other having teeth like those of a saw. The saw teeth grasped the cotton and pulled it through the teeth of the comb, leaving the seeds behind. In a very short time the cotton gin filled a bin of seeds on one side of the machine and a bin of cotton fiber on the other. The invention of the cotton gin opened a new agricultural era for the Southern States.

Cotton had been known for ages in both the Old World and the New. But so much work was required to separate the fiber from the seeds that cotton, like silk, had remained a luxury. People were clothed chiefly in wool, linen, leather, and hemp.

The cotton gin had far-reaching results. Instead of being an expensive luxury, cotton became the cheapest material for clothing. Before that time, cotton, while it could be grown in America, was grown commercially only to a very small extent because of the labor cost. The little that was used had been grown in the densely peopled East for the same reason that tea is grown there now (page 145). After the gin appeared, cotton soon became a staple crop. State after state in the South was quickly settled by people who took up new land, cleared the forests, made fields, grew cotton, and sent it to the North and to Europe, where it brought a good price.

The cotton trade. Cotton soon became, as it is now, the chief clothing material of the world. For many decades cotton was the leading export of the United States. Senators from the cotton states had a balance of power in the United States Senate, and no laws could be passed without their approval. It was said that cotton was *king*, because it was king not only in foreign trade but also in our government.

A great money crop. Cotton is a wonderful crop to sell. No insect eats it after it is picked. It will keep for years. Even a little wetting does not hurt cotton.

In the days when cotton was king, the

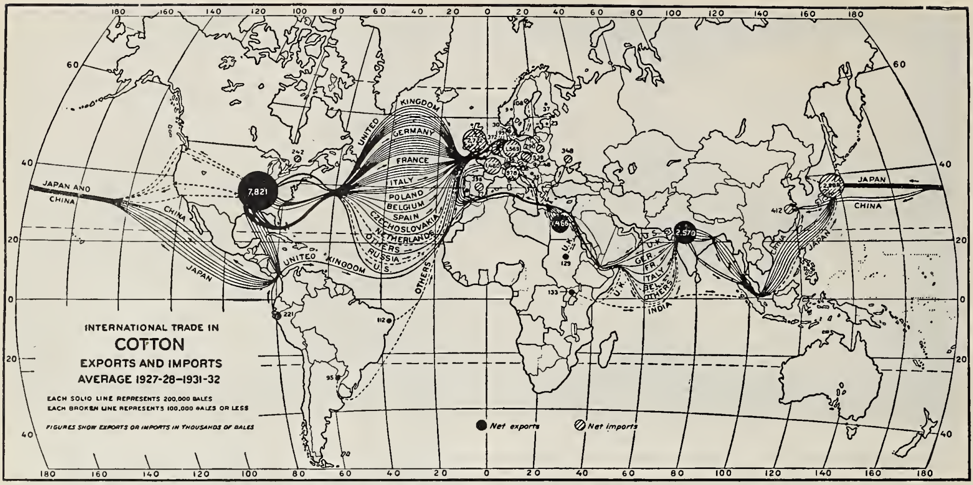


Fig. A. Write a series of sentences telling what the arrows and lines on this map tell you.

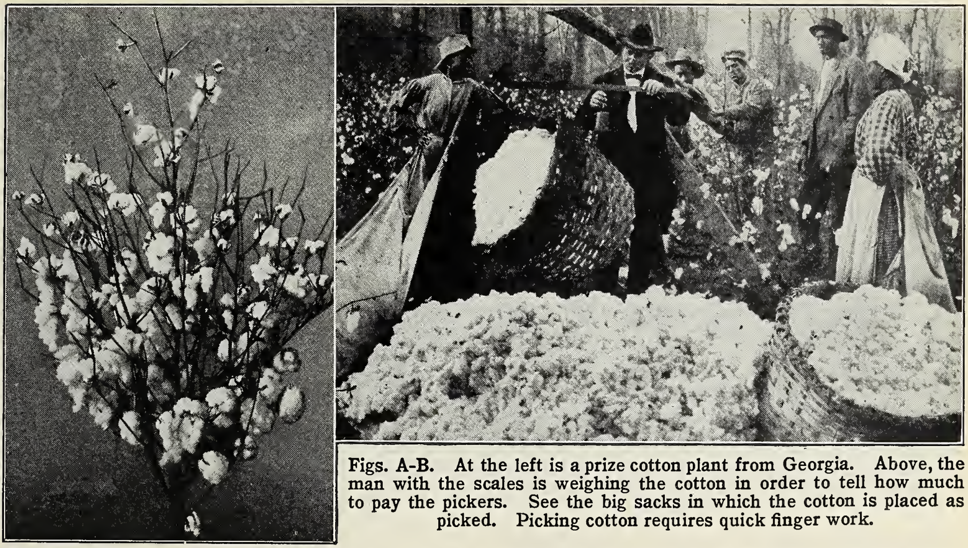
cotton farmer received so much money from selling cotton that he did not need to grow many other crops. Cotton growers had plantations much like the tropic plantations of which you have read. The cotton planters bought from the North Central States the horses and mules with which to cultivate the cotton crop. They bought the hay and corn which the animals ate. They bought meat instead of rearing meat animals. They bought canned goods instead of keeping a garden; and they bought fertilizer for the cotton plants.

The boll weevil. Then a change came about in the cotton grower's business. An insect, the boll weevil, crept unnoticed into southern Texas, spread gradually over the whole Cotton Belt, and destroyed billions of pounds of cotton. The advent of the weevil caused more cotton to be grown in the northern part of the Cotton Belt. It also spread the Cotton Belt farther west. There were two reasons for this. The weevils thrive well in damp, warm weather, but a cold winter kills so many of them that there are less left in the spring to start new generations. Arkansas and Tennessee, at the northern edge of the Cotton Belt, grow more cotton since the boll weevil came than they did before (page 359).

What has happened in Texas? The treeless plains of northwestern Texas, with their cold winter winds, are a poor place for Mother Weevil to spend the winter. Do the figures for cotton acreage in Texas show that this little insect has caused a great industry to shift? It has been the cause of the industry's moving, but the United States still stands far and away the greatest cotton producer and the greatest cotton exporter. Ships bound for other continents load thousands of bales of cotton at Galveston, Houston, New Orleans, Mobile, Savannah, Charleston, Norfolk, Baltimore, New York, and even at San Francisco and Seattle.

Cotton in China. Is the climate of southern and central China like or unlike that of a part of the United States (Fig. 2-A)? Which part? China is one of the world's great cotton growers, but her vast population uses it all and imports some (Fig. 174-A).

Climate suitable for cotton. In lands without frost the cotton plant lives and produces its seed and fiber for years. But as a matter of practical agriculture, we find that we can get a good crop of cotton if there is a frost-free growing season of 200 days. The northern boundary of the



Figs. A-B. At the left is a prize cotton plant from Georgia. Above, the man with the scales is weighing the cotton in order to tell how much to pay the pickers. See the big sacks in which the cotton is placed as picked. Picking cotton requires quick finger work.

American Cotton Belt is set by length of growing season, and most of the world's cotton is grown in places where frost kills the plants long before they are ready to die.

Why is it that a plant which lives for years in the tropics has had its most recent extension at the very northern edge of cotton land? Why are they not chopping down the equatorial forest and planting cotton fields? The answer to this question is two words—"disease" and "pests."

Tropic cotton. The cotton plant, like many other useful plants, is tender—therefore it is subject to disease. It is well flavored, therefore it is prized as food by insects. Diseases and pests that attack the cotton plant thrive in the hot, rainy, damp parts of the tropics. Although the European countries have tried very hard in the last hundred years to grow cotton in their tropic colonies, their efforts have not met with marked success. The important tropic areas of cotton production are Egypt, the plateau back of Bombay in India, irrigated parts of the coastal plain of Peru, northern Sudan, Uganda, a little of northeastern Brazil, and the Mexican Plateau.

Tropic cotton troubles. To see an example of tropical troubles, look at some of the smaller British West Indian islands, where a little cotton is grown. There the government orders that cotton be planted at a certain season and that the plants then be destroyed, in order that the pests may die before the next crop is planted.

India is one of the great cotton exporters. What is the rainfall of the part where most of the cotton is grown (Figs. 169-A and 23-A)?

The Sudan region of Africa has a climate somewhat like that of the cotton region of India. Europeans are trying to introduce cotton growing there on a large scale, but they are having their troubles. The European managers of new cotton plantations are handicapped by strange cotton diseases, by eight inches of rainfall in a single month (Fig. 2-A), and by the fact that the planters do not know how to work the soil. Nevertheless, the Sudan, with its large area, is one of the most promising places for the extension of cotton growing.

Cotton in Egypt, the American Southwest, and U. S. S. R. The best cotton of all comes from the irrigated fields of Egypt. The long fiber (Fig. 173-A) makes Egyptian cotton so valuable that

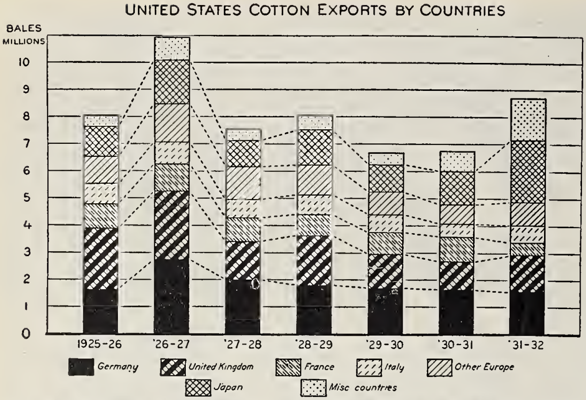


Fig. A. Exports of cotton from the United States usually comprise somewhat more than one half of the total crop. The principal export markets during the last five years were Germany, Great Britain, Japan, France, and Italy. A considerable portion of the cotton exported to Germany is reëxported to other European countries.

Egypt exports cotton to the United States. The excellent quality of this cotton caused it to be introduced into the irrigated farms in the similar desert climate at the mouth of the Colorado River in Arizona, California, and Mexico. Cotton of the Piña variety is now grown chiefly in the Salt River Valley near Phoenix. All of the plants of the Piña variety are the descendants of *one* very fine plant that grew in the United States Experiment field at Tacatan, Arizona. Does Figure 170-B help to explain why this cotton all comes from *one* cotton plant?

Central Asia cotton is grown in oases (Figs. 2-A and 169-A) that resemble in many ways those of the Nile and the Colorado. The Russian winter is colder but the summer is long and hot. A few years ago the government of Russia built new railroads southeastward to these oases, where streams from the mountains of central Asia spread water upon the fertile plains. The railroads gave the oases farmers a new market. As a result the cotton industry has boomed. But production has not been sufficient to supply the needs of Russia. Perhaps the Russians will build reservoirs in the mountains as we have done on the Colorado and its branches.

THINGS TO DO AND QUESTIONS TO ANSWER

Tell the story of: 1. Eli Whitney and his cotton gin.

2. The cotton plantations of the South.

3. The boll weevil.

Some why's. 1. Why was cotton not extensively grown in the United States in the eighteenth century?

2. Why did it become possible to commercialize this fiber?

3. Why is cotton not grown in the northern part of the United States?

4. Why is cotton a better *commercial* crop than hay or wheat?

5. Why was cotton called "king"?

6. Why has cotton growing changed during the last few years?

7. Why is cotton not grown much in tropic lands?

8. Why do we grow Egyptian cotton in the United States (Fig. 2-A)?

For extra credit. Read *The Story of Cotton*, by Brooks.

A cotton display. Collect pictures showing cotton from the time of planting until it becomes an article of clothing.

Writing questions. Write a dozen completion questions about the facts in this unit similar to the following:

Binder twine and rope are made chiefly from ————, ————*or*————. Exchange papers with a classmate and complete his questions.

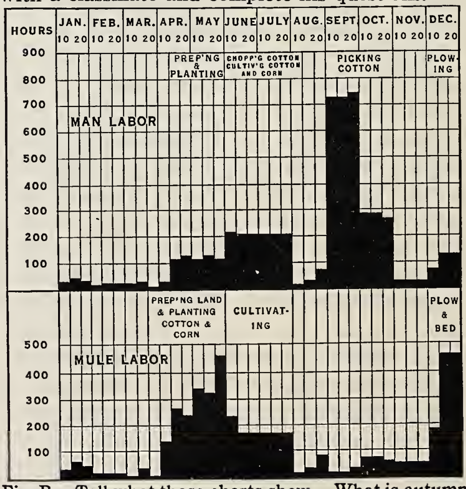


Fig. B. Tell what these charts show. What is autumn work? What about the possibility of lumbering in a Southern cotton-growing community?

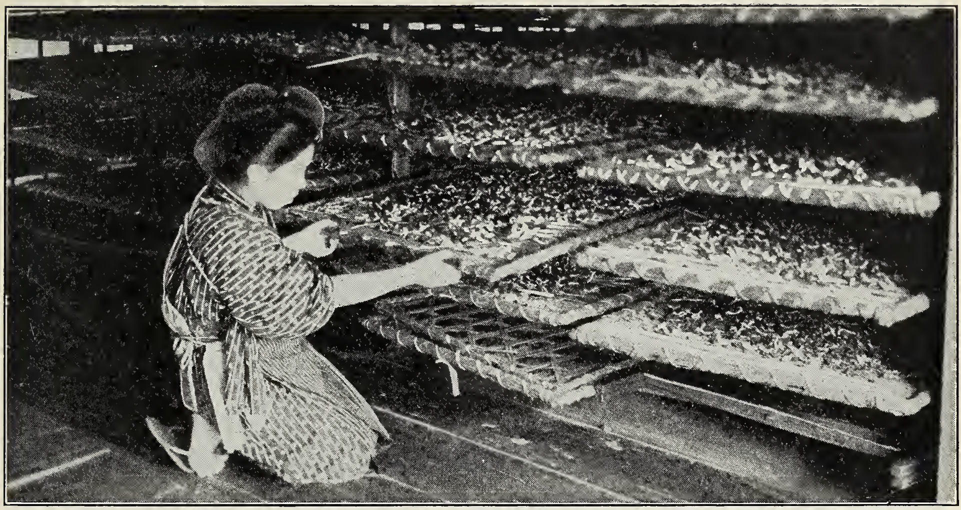


Fig. A. Thousands of Japanese homes have a room with banks of silkworm trays resting on bamboo frames. Silkworms might be likened to a very small kind of cattle. What does the woman's job and the sandal made of straw tell you about the resources of Japan?

UNIT 3—RAMIE, SILK, AND RAYON

> OTHER REVOLUTIONS. When you have finished this, say: "I made a revolution," or "I may make a revolution." Explain.

Ramie. One of the old fibers, almost a rival of linen in antiquity, is ramie. It is taken from the grass called *China grass*. Ramie was important in making clothes in China before cotton was used. The fiber, which is very strong and makes excellent fishing lines and mosquito nets, has a little gum on it which makes it difficult to get it clean enough for spinning. Small quantities are produced in China, every process being done by hand.

For years the Western scientists have been struggling to find a method to clean ramie fiber mechanically. It is now claimed that a secret method has been invented. If so, this plant, which grows well in the American Cotton Belt and yields several times as much fiber an acre as cotton does, may partly replace cotton, as cotton has largely replaced flax. We should not actually believe that a new invention will make such changes until it has changed an industry to some extent.

Fig. B. Several of these cocoons have been cut open so that you may see not only the cocoon but also the worm inside.

Silk. Long ago some ingenious Chinese discovered that he could unwind the caterpillar's cocoon and get the thread. From this discovery came the silk industry. (Figs. 177-A and 250-A.) Mulberry trees to feed silkworms have been grown for many centuries in Japan and China. The trees like well-drained soil, and so the Oriental farmer who has a nice paddy on his lower land often plants mulberry trees on the slopes and hills.

In recent years the great increase in the use of silk in the United States and Europe

has given Japan the chance to make raw silk her greatest export. Japan exports hundreds of millions of dollars' worth of silk annually.

When the silkworm eats mulberry leaves and digests them, pure vegetable fiber in the form of jelly is produced and stored in glands that lie lengthwise in the silkworm's body. Through tiny openings in the worm's head, a bit of this gummy cellulose exudes. The worm sticks it fast to a leaf or twig, then moves his head, thus pulling out the thread and making a cocoon, precisely as the spider pulls out a thread as he dangles by his web from your ceiling. The main difference is that the silkworm spins his thread in the form of a cocoon from which the thread can be unwound. The spider also makes silk, but man has not been able to reclaim it from his web. A spider's web is said to be stronger than steel of the same thickness and is used in some scientific instruments.

Rayon—or artificial silk. Ingenious chemists, copying the processes of the spider and the silkworm, have made artificial silk by treating cotton waste or other vegetable fiber with chemicals which change the fiber into a pulp or jelly, very much like that in the body of the spider or the silkworm. Again copying the methods of these insects, the manufacturers pass the mass through small openings or ducts which give the pulp or jelly the form of a fine thread. Rayon threads may be spun or woven and have a luster similar to that of silk.

Artificial silk is not yet exactly like the silkworm's product, but it is good enough to be used for so many purposes that its production increased a hundredfold in fifteen years. Rayon is manufactured in huge plants in many countries, the chief plants being located in the United States, Japan, Italy, United Kingdom, Germany, and France.

THINGS TO DO AND QUESTIONS TO ANSWER

Can you tell. 1. How long ago ramie was first used?

2. Why ramie has not been used more extensively?

3. How silk is produced?

4. What rayon is? how it is made?

A comparison. Compare silk and rayon. Remember: Process of making—looks—durability.

A future possibility. Ramie may some day replace some other fiber as a clothing material. Go to your library and ask your librarian to aid you in finding material on this undeveloped resource.

CHAPTER SUMMARY

Map. Make a map showing climatic regions (Fig. 2-A) which produce a good fiber. Show chief producing sections for several fibers.

Fill in the following table:

Name of Fiber	Greatest Producers	How Prepared	Uses

Finding explanations. 1. How machines have opened new fiber resources to man.

2. Why the United States is not a great silk producer.

3. Why the United States is the world's greatest producer of cotton.

Answer these questions by using your tables. 1. What state produced the most cotton in 1931 (page 359)? How much more or less than the 1900 crop was the 1931 crop? Can you get later figures?

2. What states have lost in cotton production between 1900 and 1931? Which ones have gained?

3. Compare the United States' importation of jute and jute products for the years 1928 and 1932. Can you explain the difference?

4. Study *Yearbook, United States Department of Agriculture,* table and make graphs showing leading producers of flax *fiber* and of flax *seed.* What do you notice about the climates of the areas producing these two flax products?

Think about these. 1. Examine the pictures in this chapter and see whether they show why some fibers should be cheaper than others.

2. Make a list of cotton *exporting* countries; of cotton *importing* countries (Fig 174-A). Which continent leads in exports? in imports?

3. Make a table on:

(a) Struggles of man in growing cotton.
(b) Ups and downs in fibers.
(c) The parts of plants that yield fiber.

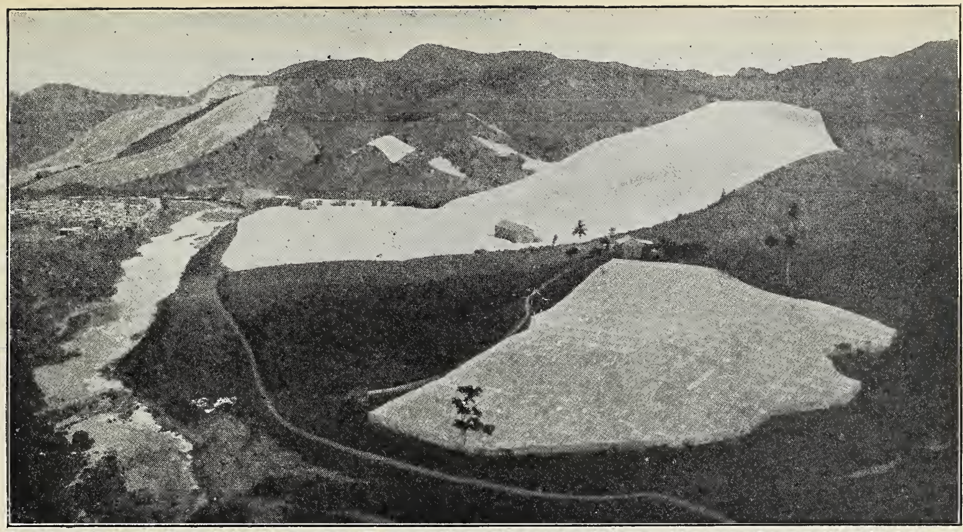


Fig. A. In the Valley of the Connecticut River and in other parts of the world a very fine quality of tobacco is grown under cotton screens such as you see in this picture. This view was taken in Puerto Rico.

CHAPTER XVII

TOBACCO

UNIT 1—WIDESPREAD PRODUCTION AND WIDESPREAD TRADE

A Crop Comparison. Is the tobacco industry more scientific, more laborious than the wheat industry?

Commercial qualities of tobacco. The Jamestown colonists in Virginia were greatly disappointed in the failure of their grape culture (page 134). They were about to give up and go back to England when a returning ship brought news that a trial shipment of tobacco had sold for a high price. The colonists decided to remain and began to grow tobacco. Since the European markets wanted nothing else that the Jamestown colonists could grow, it was fortunate that the Indians had taught them to grow this American plant.

For generations tobacco was the chief money crop of the farmers along the shores of the Chesapeake and its tributary streams. Tobacco served as money. Taxes and fines were paid with tobacco. Even the pastors of the churches were paid in tobacco. Farmers cut down the woods and planted more tobacco. The plant needs much fertility, is a greedy feeder, and soon robs the soil of its plant food, so the colonists cut down more woods to make new tobacco fields. This process still goes on, although in some localities regular crop rotations have been worked out.

Tobacco will keep for years without spoiling. It is not subject to attacks of insects or rodents after it is cured. These excellent commercial qualities have caused tobacco, like cotton, to be the sole dependence of one-crop farmers.

Soils suitable for tobacco. Tobacco takes its flavor in part from the soil. If the soil is too rich, the flavor of the tobacco is bad. So the selection of soils for growing tobacco and the fertilizing of these soils is a matter for experts. Certain limestone soils in western Cuba give a flavor much desired in cigars. Certain very poor, sandy soils in Connecticut permit the farmer to fertilize the soil to give it desirable qualities.

The tobacco climate. Tobacco needs

Fig. A. Tobacco leaves, fresh from the fields, ready to be hung in a tobacco barn to cure.

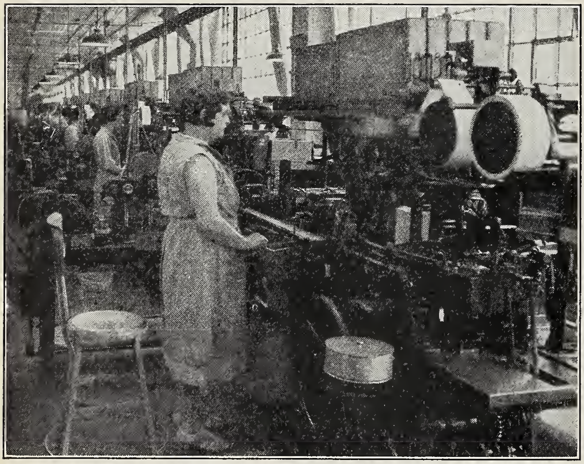


Fig. B. Inside the big factory in Figure 181-B, girls operate cigarette machines which take paper and tobacco at one end and turn out packages of cigarettes at the other.

a climate much like that required by corn—a moist summer with a growing season of at least five months. Like corn, tobacco is grown from Minnesota to the Equator. In some places the tobacco grower puts thin cotton cloth over his tobacco field. The cloth keeps off the wind which might break the leaves, and keeps the air damper. Moisture causes the plant to have a thinner, more tender leaf of better quality for cigar wrappers. Such shade-grown tobacco is produced in Connecticut, Florida, Puerto Rico, and Sumatra. It is an expensive process, however, and most of the world's tobacco is grown in the open fields as are corn and wheat.

Tobacco crops and markets in the United States. The territory lying between the mountains and the sea in Virginia, Maryland, and North Carolina has been an important tobacco region for nearly or quite 300 years. Its rival region is just across the mountains in Kentucky and Tennessee. Small quantities of tobacco are grown in the Connecticut River valley in Connecticut and Massachusetts, in southeastern Pennsylvania, and in Wisconsin. Louisiana produces a small quantity of the kind known as *perique*.

Each year tobacco buyers from many European countries visit Kentucky and North Carolina. In visiting Louisville and Lexington in Kentucky, and Winston-Salem, Durham, and Wilson in North Carolina, you will often see hogsheads of tobacco. These huge containers filled with tobacco are also often to be seen being loaded into ships at Norfolk and New Orleans. These cities are two of the greatest tobacco-shipping ports of the world.

In Durham, Winston-Salem, and Richmond are factories which make cigars and cigarettes, various kinds of chewing and smoking tobacco, and snuff. A very complicated machine will take a hopper of tobacco and a roll of paper, make a cigarette half a mile long, and cut it into cigarette lengths as it comes out.

Tobacco from the United States probably

goes to more places than any other American product except possibly cotton.

The leaf stems, stalks, and refuse tobacco are used to manufacture nicotine sulphate, a poison used in spraying trees in the orchard and plants in the flower garden to kill insects.

Tobacco in Europe and Asia. Some tobacco is grown in Italy, Greece, Turkey (Europe and Asia), Yugoslavia, Hungary, Rumania, Bulgaria, Poland, and Russia. But the total is but half the amount of tobacco that is grown in the United States. Europe imports heavily from this country and from Cuba. At the same time, because of differences in flavor, we import tobacco from Italy and Greece, so-called Turkish tobacco. Most of this tobacco is grown in the relatively dry climates in the vicinity of Thessalonikē and of Izmir (Smyrna). It is surprising that Europe does not replace many of her grain fields that yield low income with a greater income-producing crop like tobacco. But it so happens that the Europeans prefer the flavor of American tobacco. Some parts of Europe have been getting tobacco from the same locality in the United States for 300 years. Europe cannot produce *American* tobacco. Small amounts of tobacco are grown in Japan, Chosen, and China, but these countries, too, are importers from the United States.

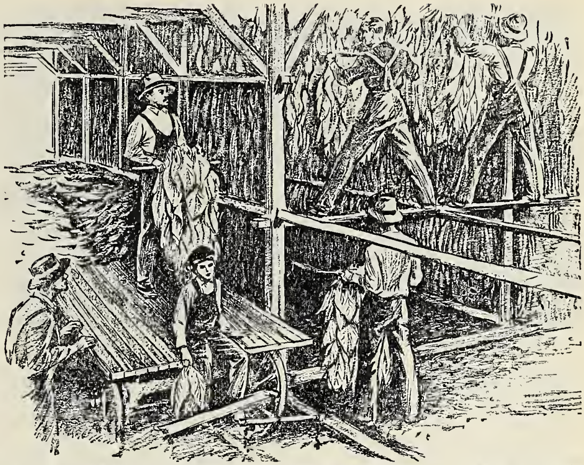


Fig. A. After much hard labor as it grew, each tobacco plant is fastened to a stick and hung in a tobacco barn to "cure" as it dries. Then the leaves are taken off by hand and bunched according to size and quality. Later the leaf is separated from the rib by hand; but it must lie in hogsheads for two or three years to ripen before being manufactured.

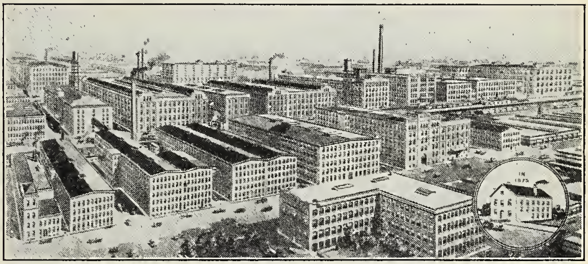


Fig. B. This picture of one tobacco company's plants in one city shows one of the results of mass production in this industry. A few companies manufacture nearly all of the tobacco, other than cigars, in the United States.

Tobacco in the tropics. India is second only to the United States as a grower of tobacco. She produces more than Europe. Tobacco in India, however, is grown as a garden crop for home use, has no standard grades, and is of no *commercial* importance. In Cuba and Puerto Rico tobacco is the export second to sugar only.

In all continents in the tropics a few tobacco plants for home use are often found beside the thatch house of the patch farmer. Here and there a little tobacco is exported. I have seen on the docks in Hamburg packages of tobacco wrapped in two layers of untanned cowhide. The cowhide protected the packages as they were carried on mule back down from the Andes of the interior of Colombia to the steamboats on the Magdalena River. But this trade is unimportant. In Sumatra, Dutch companies have cleared away the forest, imported coolies, and made tobacco plantations in the same way that they have made plantations of rubber, spices, sisal, abaca,

Fig. A. A tobacco warehouse at Winston-Salem, North Carolina. The farmer hauls his tobacco to the warehouse. The tobacco is placed in baskets, weighed, and graded. Buyers representing the tobacco manufacturers and dealers, bid upon each basket of the leaf. Sometimes as many as 12 buyers will bid on the same basket, quality and supply and demand being the controlling factors as to price offered. As soon as a basket of tobacco is sold, the grower is issued a form of receipt which shows the number of pounds and the price. This receipt can be cashed at the bank.

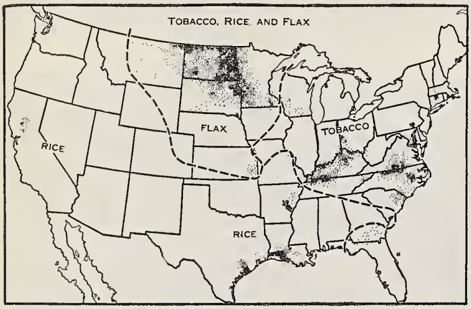


Fig. B. Each dot on this map represents 2000 acres of tobacco, rice, or flax.

Fig. C. In colonial times, tobacco, the chief crop of Virginia, was packed in hogsheads and rolled away from the plantation to the wharf on the river, whence it was shipped to England.

tea, coffee, and other crops. The Philippine Islands also have tobacco as an export.

Constant demand. Tobacco is a habit-forming plant; sometimes people will go hungry but buy tobacco. Therefore, the industry has grown with great rapidity. Advertising has been so highly developed that the output of tobacco remained more constant than that of most crops during the great financial depression that began in 1929.

CHAPTER SUMMARY

Do you know these things about tobacco? 1. How tobacco affects the fertility of the soil?

2. How the soil affects the tobacco plant?

3. What excellent commercial qualities has tobacco?

4. How is the climate best suited for tobacco similar to that needed for corn?

5. The two greatest tobacco-shipping ports?

6. Where American tobacco is used?

7. What becomes of the refuse tobacco?

8. Is tobacco growing an intensive form of agriculture?

A comparison of regions. 1. Using Figure 2-A and your knowledge of tobacco, pick out parts of the world that might be utilized for growing tobacco.

2. Examine the list of tobacco producers (Fig. 182-D). Find the different climate belts in which tobacco is produced.

Make a graph. Get *Yearbook* figures and make graphs showing: (a) tobacco acreage leading states; (b) tobacco production leading states; (c) same for states east of the Appalachians and for states west of the Appalachians; (d) yield per acre in leading countries.

Reading your graph. 1. What country is the greatest producer of tobacco? What country is the second greatest producer?

2. What country is the leading tobacco exporter?

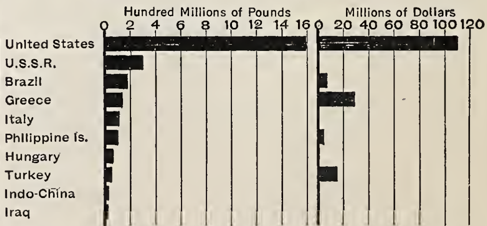


Fig. D. Production of tobacco by leading countries. Notice value in comparison to price of the tobacco from Greece and Turkey.

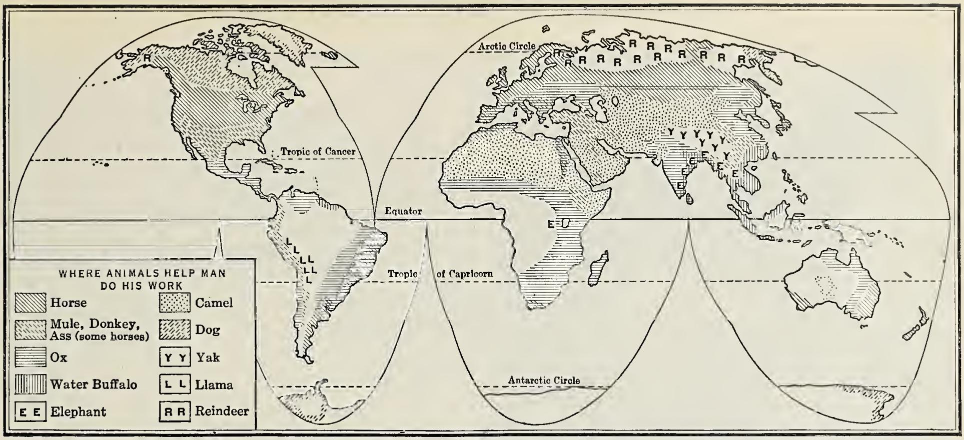


Fig. A. This map shows, in a general way, the distribution of work animals throughout the world.

CHAPTER XVIII

BEASTS OF BURDEN

Great importance of beasts to man. If man depends entirely upon the strength of his own muscles (Fig. 204-A), he can have but few things and life is hard. Life became much easier for our ancestors when they tamed animals, rode them, and also made them draw a sled, a plow, and later that very great invention, the wheel and axle.

We have invented many kinds of engines and have built many tractors, trucks, trains, and motor cars, but man still uses at least a dozen kinds of animals to help with his work and to carry burdens. Most of the food for the human race is still produced on land plowed by animal power. Famine would sweep the earth if all beasts of burden ran away.

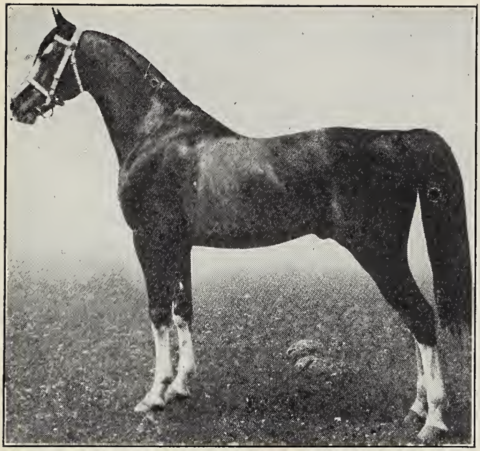
In nearly all climates man has one or more animal burden bearers. These differ with the climate and the possible food supply. The equatorial forests of Africa are the largest region where man must depend upon his own muscle or use a machine. This is true because in many parts of that region an insect called the *tsetse* fly spreads diseases which kill both horses and cattle and sometimes men also.

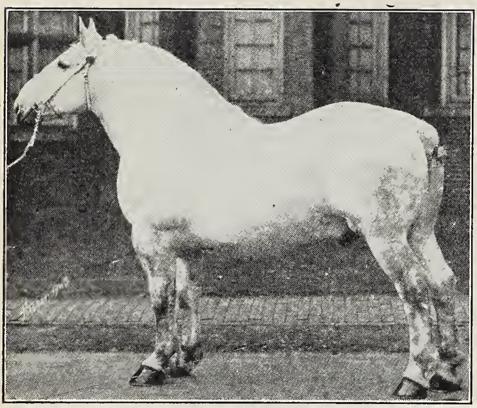
UNIT 1—HORSE, DONKEY, MULE, AND CAMEL

> Literary Imagination. Write a proper dialogue between a horse, a donkey, a mule, and a camel. Each animal is very proud of the help he has given man and each wishes to make much of himself. Bring as much geography as possible into the story.

The horse. The horse is the favorite beast of burden. A good horse is beautiful. He loves his master. He loves a race. Many poems have been written about him. The Arab chieftain is said sometimes to love his horse more than he loves his family. Even now, in the day of the automobile, when Arab chieftains from the desert go up to Alger to great public functions, they take their horses in freight cars, that they may ride on horseback through the streets of the city as befits a chieftain.

The animal of rich lands. The horse requires good grass or hay, also grain. He is, therefore, found in farm country where there is abundant summer pasture—Europe north of the Mediterranean, north central Asia, Argentina, the northern half of the United States, the more humid parts of South Africa, and Australia.





Figs. A-B. This pair, the Arab horse bred for speed and endurance, and the French Percheron bred for slow strength at plow and wagon, show how by selection man can change the domestic animals.

Types of horses. In different places horses have been bred in three main types: (1) Big, thickset, heavy draft animals for heavy work on farms and in city streets; and also a lighter type of farm-work animal. (2) Slender, swift race horses, descended from the Arab steeds brought to Europe by the Crusaders. (3) Ponies. The third class are merely horses stunted in growth in lands where the winters are long and hard or the summers are so dry that food is scarce and animals are often hungry. Shetland ponies, Iceland ponies, Mexican ponies, Russian ponies, Manchurian ponies are the names of some of the many breeds of ponies.

The camel. The camel, sometimes called "the ship of the desert," is the opposite of the horse, in that he can live upon the poorest of pasture. He can maintain himself on thistles, desert shrubs, and a little grass. He can, if he has to, carry a burden for some days across a hot desert without drinking any water. Of course, after such a strain he must rest and fatten again.

Camel land. Find in the Eastern Hemisphere lands of little rain (Figs. 22-A and 23-A). There you have camel land. The camel is found from southwestern Morocco and the westernmost tip of Sudan to northeastern Mongolia. He tramps the streets of Cairo and Karachi; of Aden and Astrakhan; Damas and Tehran; Samarkand and Peiping, and he treads every dusty, stony trail throughout that vast region.

In such land, where population is scanty, there are few roads—just trails across the barren, cropless country. Therefore, the camel's chief use is as a saddle animal and as a pack animal in caravan. Sometimes he draws a wagon or a plow or a reaper, but this is exceptional.

Two types of camels. The camels south and west of the mountains of northern Persia have one hump. Those north and east of Persia are the two-humped Bactrian camel. *Bactria* is the ancient name for the eastern part of the Plateau of Iran.

Camels have been introduced into the desert sections of Australia. The United States Government made an importation of them for use in our own Southwest, but they arrived just before the Civil War. Because of the war, they were neglected and were probably eaten by wolves.

The donkey or ass. This small, long-eared, loud-voiced animal is a cousin to the horse. He is also a neighbor to the camel, and is found in most places where there are camels. The ass today runs wild with the wild camel in Mongolia. He shares somewhat the camel's ability to live on thorny

Fig. A. A camel caravan in Arabia. Find the tops of the date palms in a valley oasis. Sheep, goats, donkeys, and camels pick their living on the scattered bushes of such bald lands as this.

bushes and other harsh fare. A few donkeys are often to be seen in camel caravans.

Like horses and cattle, donkeys have been carried to almost all inhabited countries. In southwestern United States the prospector hunting for metal usually has a burro (donkey) or two. They carry his equipment and pick their living by the way.

The mule. The mule is a hybrid. His father is a donkey, his mother is a mare. Therefore, the mule is larger than the ass and smaller than the horse. From his father's side come long life and the ability to stand harder conditions than the mare, his mother, can stand. Mules are in common use in Mediterranean countries. They are man's chief animal helpers in underground mines in many lands.

In the United States there are more mules than horses in every cotton-growing state in the South except Oklahoma.

THINGS TO DO AND THINK ABOUT

A map of man's helpers. On an outline map of the world show the regions in which the animals mentioned in this unit are used as beasts of burden. (Keep your map.)

Can you answer these? 1. Why is man still dependent on animal power?

2. Why are there no horses or cattle in the equatorial forests of Africa? How does this affect the lives of the people living there?

Fig. B. Family and produce going to market in Cyprus. The donkey has a stronger back than the horse and he carries frightful loads in all continents. He is especially used in Mediterranean countries and the drier parts of Asia.

3. Which part of the United States has the most horses? the most mules?

4. Why can a donkey carry such heavy burdens?

5. What two kinds of camels are there? What qualities does the camel have that adapt him to special uses? To what uses is he put?

6. Tell why man uses so many different beasts of burden.

For extra credit. 1. Choose two members of your class to report on the tsetse fly and on the different breeds of horses.

2. Tell about conditions of living before and after men had domestic animals.

Fig. A. This elephant, strong, intelligent, and obedient, moves the teak log as his Siamese master directs. Why the chains?

UNIT 2—THE OX, THE BUFFALO, AND THE ELEPHANT

ANIMAL CONVERSATION. Let three oxen, three buffaloes, and three elephants, each from a different country, tell stories of their lives which shall also be good geography.

The ox. "Why don't you use quick-stepping mules rather than these slow, creeping oxen to do your plowing?" I asked the manager of a Portuguese estate.

"You see, Sir," he replied, "the ox eats straw, the horse and the mule need some grain. It costs less to feed an ox and, finally, we eat the ox (sausage)—but we do not eat mule."

The ox creeps along slowly, but he is very strong and very patient. Since he lives chiefly on straw and lets man and the other animals have the grain, he might be called the *work beast of poverty*. We find him in lands of poor pasture, poor people, and scanty grain.

The ox is used to a small extent in many countries. He is very common in all Mediterranean lands, but is used to the greatest extent in India. India has more cattle than has any other country in the world. A few are dairy cattle, a few are beef cattle, but most of them are work animals.

India has special breeds of strong work oxen, and fast trotting ones which for generations have pulled the little passenger carts (taxicabs) through the city streets.

The buffalo. A species of buffalo, native of southeastern Asia (Fig. 189-B), is a cousin to the ox and does the same kind of work. We might call him the beast of summer monsoon lands. The buffalo does not mind wading knee deep in the mud of a rice paddy. He is the chief work animal of large areas in the wetter parts of China, India, the lands between them, and the East Indian Islands. The water buffalo is to be found all the way from the East Indian Islands to Hungary and the Hwang Ho Valley of China. On millions of Chinese farms a water buffalo, or the common cow, not milked, is the only work animal.

The elephant. The elephant, native of the tropic forests of Africa and southeastern Asia, has been used as a work animal for centuries. Elephants bore burdens for the Carthaginian armies that invaded Rome, but the domestication of the African elephant was for centuries a lost art. He does not tame so easily as the Indian species, but now the Belgians are again trying to tame elephants in the Congo.

In the moister parts of India, Ceylon, Burma, Siam, and Indo-China elephants have been used for a long time chiefly in handling logs, although they sometimes pull plows and wagons. With their great strength, their marvelous trunk, and the tusks that serve as stout pikes (Fig. 186-A), they are well equipped for heavy work. They are also very intelligent.

THINGS TO DO AND QUESTIONS TO ANSWER

For your outline map. Add the regions and the animals mentioned in this unit.

A comparison. Find pictures of Indian cattle. This book has several. Compare them with cattle that you have seen.

Do you know? 1. What special qualities has the ox as a work animal? the buffalo? the elephant?

2. Why can the ox be called the work beast of poverty?

3. Which country has the most cattle?

4. Why are water buffaloes adapted to raising rice?

UNIT 3—YAK, LLAMA, AND REINDEER; DOG, GOAT, AND SHEEP

A COMPARISON. Show that one of the following animals is a better fit than the others in the place where he works—llama, reindeer, dog.

The yak and the llama. These animals, very unlike (Figs. 187-A and 187-B), are mountaineers and natives of similar lands in widely separated regions.

The yak still runs wild, but he is the chief domestic animal of the cold, bleak, windy, treeless, arid plateau of Tibet. He thrives so well on the mosses and other scanty vegetation of the cold plateau that he will not eat corn. Nevertheless, he is a noble beast six feet tall at the shoulder, and of great strength. To make life easier in his cold and snowy home, the underside of the body of the yak is covered with long hair, so that when he lies down on the snow he has his own hair mattress under him. In parts of Tibet yaks are the only burden bearers. They are used chiefly as pack animals in a mountainous and roadless land. Exploring parties in Tibet and the Himalayas use yaks to carry their luggage.

The yak has also been introduced into northern Canada and Alaska, where he seems to thrive.

The llama. The slight, slender mountaineer—the llama—is a native of the Andes, where he was used by the natives long before white men came. It is said that the early Spaniards sometimes rode llamas, but this use is unusual. Llamas serve mostly as pack animals on Andean trails. They pick their living as they go. The fleece of llama wool brings as much in the market as sheep's wool. Llama meat is good for food. Despite these advantages the llama has not been introduced into any other region. Perhaps this is due partly to his manners. If a llama does not like you or the way you treat him, he will spit upon you, very accurately and very unpleasantly. If the llama objects to the burden you put upon him, he will lie down. He will not

Fig. A. The yak, with a hair mattress under his body to keep him warm when lying on snow or ice, is the reindeer's rival for the snowy land. Some day we may have herds of these natives of bleak and cold Tibet sharing the pastures of Alaska with the reindeer from another cold part of the Eurasian continent.

Fig. B. This long-legged, woolly, stubborn, scornful fellow is as much at home on this cold Andean plateau as is the yak in Tibet. Like the yak and the reindeer, he can pick his living as he goes—if there is anything at all to pick.

rise till he is ready. An animal with a spirit so independent is rather a difficult problem as man's helper.

The reindeer. The reindeer is an Arctic specialist and is remarkably equipped to survive the winter of his frigid home. Air cells in his skin make his skin the

Fig. A. This scene in the bald mountains of western Tibet shows goats carrying burdens, pack-mule fashion, on land so rough that no other animal can travel over it. Find a bush and tell its part in the story.

Fig. B. The reindeer is as much at home in the snow as the Asiatic buffalo is in the water or the camel is in the desert. He has drawn the sledge for Santa Claus and the people of northernmost Europe and Asia for a long time. This little Swedish boy shows that the reindeer is also an animal used for riding.

warmest of leather. The reindeer also has a thick coat of hair so that he has no more need of a barn than has a rabbit. In winter the reindeer digs through the snowdrifts with his big hoofs and gets mosses, lichens, dried grass, and twigs. On these he lives as he traverses the snowy land. In summer his flat feet support him on the soft, muddy tundra land. The reindeer is a tame caribou.

At the present moment the caribou is wild in the Great Northern Forests and the tundra of North America, Europe, and Asia. We do not know how long he has been domesticated, but in the fourth century A. D. a Chinese traveler, returning from a journey far to the north, gave an account of the reindeer as a domestic animal.

In wide expanses of northern Siberia the people are very properly spoken of as *reindeer people*, because these animals furnish the people with clothes, tents, meat, cheese, milk, and transportation. The peoples of northern Asia sometimes ride reindeer, but the reindeer's greatest work is drawing sledges. You probably remember that the Lapps of northern Finland and northern Sweden are also reindeer people.

The successful transporting of reindeer herds to Alaska is causing the Eskimos to turn from dog sleds to reindeer sleds as a means of travel.

The dog in the Arctic. The dog is a rival of the reindeer as a carrier in the Far North. The Eskimo living on the Arctic shores of North America, where fish and seal abound, has long had the dog as his only domestic animal. Admiral Peary, who discovered the North Pole, used Eskimo dogs and Eskimo drivers in all of his many Arctic journeys.

Fig. A. A trapper with a dog team and sled of furs going to the trading post. In exchange for the furs which will be shipped to market, he obtains his provisions.

In some parts of Alaska, dog sleds carry the United States mail. One of the exciting annual events in Alaska is a long-distance dog-sled race. Such a race is also held each year at The Pas, in northern Manitoba.

Work dogs in Europe. Many a time in central Germany I have seen a woman from a farm village come into town with a dog or dogs drawing a small wagon loaded with farm produce. On reaching the market the woman would, in cold weather, put blankets on her dogs and give each dog a board to lie upon. The woman sold her produce from the wagon.

Dogs are used to some extent in Belgium, France, and Germany to draw milk carts and carry small produce to town, but their use is declining as automobiles increase.

Goats and sheep. The wild goat is a rock climber in his mountain home, and the ability of the domesticated goat to walk in very rocky places makes him a very unusual beast of burden (Fig. 188-A).

The populous plains of northern India provide the market for some of the sheep raised by the Tibetan shepherds. The sheep walk down the Himalayas to market. Sometimes each sheep has a small bale of wool or other produce tied to its back. Sixty pounds is a common load for a sheep.

Fig. B. The Asiatic water buffalo spends all his spare time in hot weather lying in the mud with only nose and eyes sticking out. They have a saying in the Philippines that when he is working he goes crazy if he doesn't get one good bath each day. This little Philippine girl let me take her picture while she let the family buffalo have his morning splash in the stream beside her home in Luzon.

THINGS TO DO

For your outline map. Add the regions and the animals mentioned in this unit. Mark some places where you think the yak might be introduced.

Two questions to answer. 1. How has nature provided for the yak and the reindeer?

2. Why is the llama not more widely used as a beast of burden?

Write a paper. Tell what you know about the use of dogs and sheep as beasts of burden.

CHAPTER SUMMARY

New words: Tsetse fly, caravan, burro, forage, hybrid, domestication, pack, axle. Use these words in sentences.

Man's domestic animals. Choose various places in the world. Assign each of these places to some member of your class. Let him prepare a report as follows: I live in ———. I use ———, because ———.

Fig. A. This is the way that Nebuchadnezzar and George Washington moved dirt when building canals (page 59). In this way canals were built to irrigate land to grow crops to feed millions of people in the Indus Valley thousands of years ago. Oxen did a little of the work on a recent new canal (Fig. 191-B).

CHAPTER XIX

THE FUTURE OF FARMING

UNIT 1—RECENT CHANGES IN FARMING

Farms and Depressions. Explain how the depression of 1929–34 had a different effect on the farmer who grew only wheat (page 73) or sugar cane (page 156) and the farmer who did as they did in George Washington's time (page 5).

"Hard times." For several years before 1934 commercial farmers in United States, Canada, and many other countries received very low prices for their produce. The farmers complained of hard times and the people who sold things to the farmers also had hard times because farmers had so little money to spend. What had happened to cause this trouble?

In 1918 there was about the same number of farms in the United States as in 1931 and about the same number of farmers. The amount of work done by the farmers' sons and hired help had declined 9 per cent. The acre yields of crops were about the same. Yet the farm produce on the markets had increased about one third. What caused this mystery? We shall consider several factors, each of which helps to give the answer.

1. Tractor, truck, and automobile. In the years 1918–1933 these machines had caused a decline of about 9,000,000 horses and mules on farms in the United States and a decline of probably more than 1,000,000 in the cities. The 30,000,000 acres of crop land and other millions of acres of pasture land that had been required to feed these work animals were now free to produce other things—milk, wheat, meat, cotton.

The tractor and the combine (Fig. 61-A) enable one man to cultivate much more land than he could cultivate with horses. Therefore, 33,000,000 acres of new land were brought under cultivation, mostly in the Middle West (Fig. 58-A). But at the same time low prices had caused 32,000,000 acres of old land to go out of cultivation in the East (Fig. 200-A). Much of it was growing up to woods and bushes, and for the first time forest and brush land increased in extent.

2. More efficient animals. The number of dairy cows in the United States increased between 15 and 20 per cent, but the amount of milk which they produced was about 50 per cent greater, because the farmers were

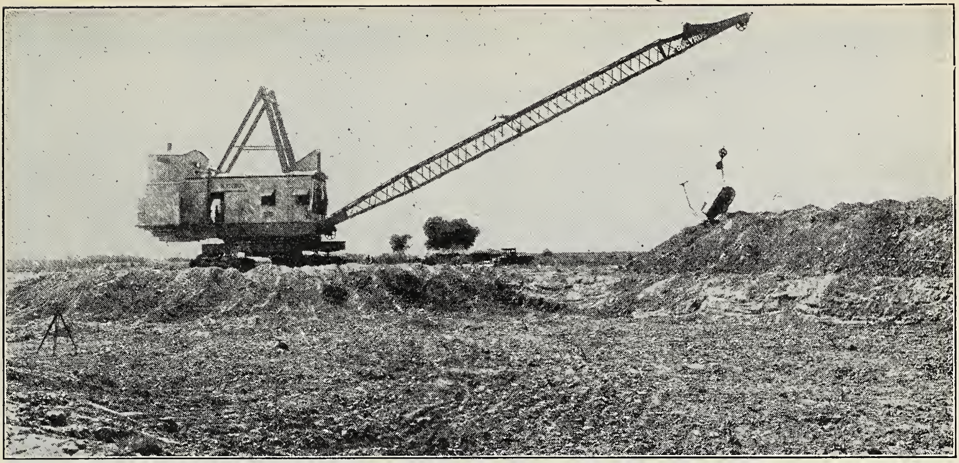


Fig. A. This is the way the British engineers built the new canal in the Indus Valley. This one machine from the United States moves more earth than could a field full of oxen. Can you show some similarity to this in Figures 190-A and 240-A.

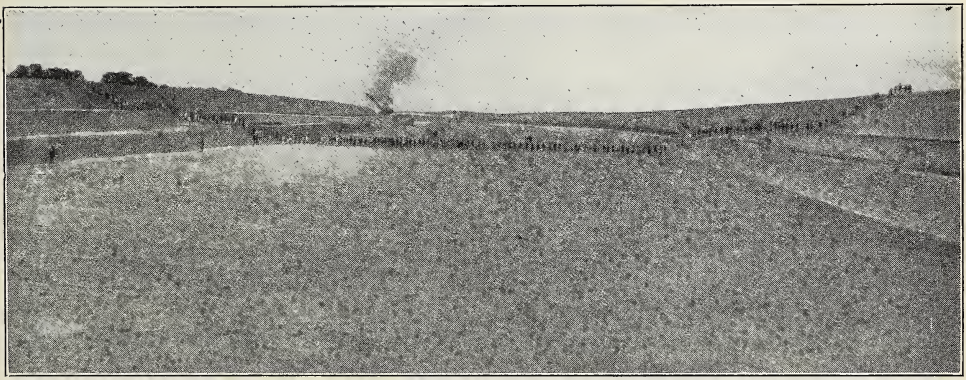


Fig. B. Rice canal at Ruk. Find the machine from the United States. This canal in the Indus plain will carry water to grow more crops than grow in any one of several of our American states. Examine it carefully and tell about how wide it is; how deep. The age of machinery and mass production may produce many such canals if we can manage our industry wisely. This one is in the lower Indus Valley near Karachi.

feeding their cows more scientifically. Those that gave little milk were sent to the sausage factory, and only those that gave the most milk were kept. Although the number of pigs was decreased by 11 per cent, we had nearly 30 per cent more pork, because the pig was forced into early growth and sent to market at an earlier age. This made the pig a more efficient user of feed. The farmers had also shifted from the production of beef, which makes less efficient use of farm forage, to milk cows, hogs, and chickens, which are more efficient users of food. This improvement of animals had increased our food supply as much as would have been the case had we added 25,000,000 acres to the crop area of 1918.

3. Food increased faster than people. Food had increased faster than population had increased. The farmers of Europe were also improving their production. It is reported that in a recent five-year period the farmers of Denmark increased the national crop by 25 per cent. This helps to explain the fact that Europe is importing less food from us than in previous years. This of

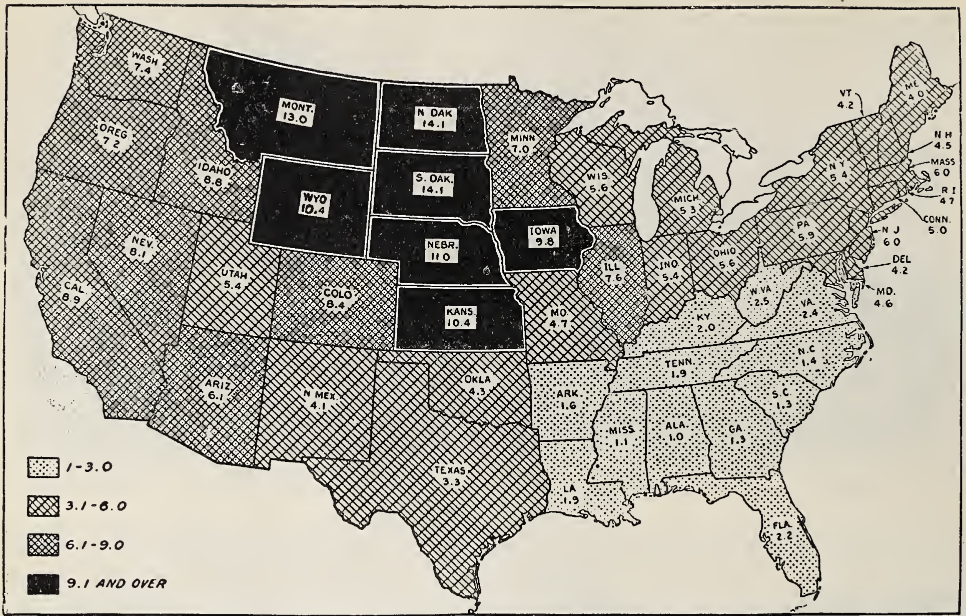


Fig. A. Horse power, animal and machine, per full-time farm worker. How does this help to explain the glut of the wheat markets? See Figure 63-A.

course made for hard times on the American farms. Produce had increased faster than population had increased. Supply had increased faster than demand had increased.

Machines on the farm had replaced some of the men, and so the men had moved to the cities. In extensive areas of farming districts there were fewer people in 1928 than had lived there ten or twenty or even thirty years earlier, but the number of people living in cities had increased greatly. During the depression that began in 1929, many city people out of jobs went to the country to live. This reduced city-market demand and tended to embarrass the farmers still further.

THINGS TO DO AND QUESTIONS TO ANSWER

Farmers. 1. What is meant by thatch-and-patch farmer, domestic farmer, and the commercial farmer?

2. Describe the lives of each and how they differ.

3. Which one suffered most by the depression? Why?

4. Do you think the Pygmies (page 1) were having hard times in 1934? What would make hard times for them?

5. The people in the farm villages in the interior of Asia Minor grew their own food, made most of their own clothes, cut their own firewood on the hills near by. They bought little. They did not understand why a great, rich country like the United States was having hard times in 1933. Explain.

Problems to make you think. 1. Name three reasons for the decline in the price of farm products.

2. What effect does increased production of farm products have upon their price? Why? Draw a chart to explain your answer.

3. With the increase of factory work and the increased use of farm machinery, where did the laborers turn for work? Why? How did the wage problem affect this trend? Draw a cartoon to represent this change.

4. Explain why people returned to farms between 1930 and 1934.

5. Tell something about Figure 194-A, and use the words *wealth, poverty, efficient animals.*

Extra credit. Examine Figures 191-A, 191-B, and find parts of the world where such things might help make more farms.

Fig. A. Sudan grass plant five feet high, ten weeks old. This rapid grower is a new crop which is increasing the producing capacity of many American farms.

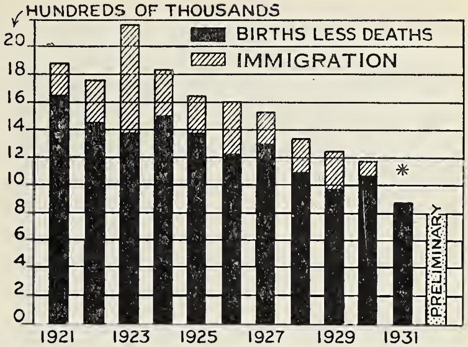


Fig. B. In 1921 the population of the United States was increasing nearly 2,000,000 a year. In ten years the increase was less than 1,000,000. A stationary population is approaching rapidly, but it appears to be twenty years off or longer. The uncertainties in the situation are: (1) whether restrictions on immigration will be relaxed; (2) how long the downward trend in the birth rate will continue; and (3) how much the average span of life can be lengthened.

Fig. C. Sweet clover growing at right of this picture is a newly introduced plant that rivals Sudan grass in increasing the productivity of land. It *must* have lime in the soil. The seeds of sweet clover and red clover were sown on all the land in the picture. On the left there is half a crop of red clover and no sweet clover. At the right, which had an application of ground limestone nine years before, there is a fine crop of both clovers. Farmers now test the soil to see whether it has lime.

UNIT 2—THE FUTURE NEED AND THE POSSIBILITIES OF INCREASED PRODUCTION IN THE UNITED STATES

PROBLEM. Prove or disprove the statement "Agriculture is one of the most scientific industries."

The demand for farm produce. In 1920 the population of the United States increased more than a million and a half. In 1931 the increase was about three fourths of a million. The decline was due partly to our refusal to allow immigrants to come here from foreign lands, and partly to the fact that fewer children were born in the United States. This is true especially in the cities. If changes in birth and death rates (Fig. 193-B) of the last fifteen years are continued, it will not be many decades until the population of the United States is stationary. A committee of experts in Great Britain estimates that population in that country will be static by 1944, with almost no increase between now and that time. Therefore, the farms may not be called upon for much increase in the production of food or fiber. We have already read (pages 74 and 156) of the glut of sugar and wheat.

The supply of farm produce. Recent careful studies show that since we have so many automobiles and other machines, the average amount of food consumed by each person is less than it was years ago. But the age of science seems only to have begun.

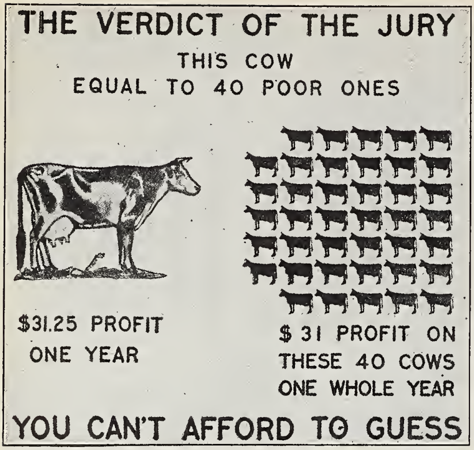


Fig. A. A farmer who did not test his cows and get rid of the poor performers kept forty cows which made him no more profit than *one* good cow made. Tell something about cow-testing associations.

Fig. B. The people of Greece have kept goats for milk for several thousand years, but the *Swiss* have bred and selected their goats scientifically. These Swiss Toggenburg goats being held by the Greek schoolboys were given to a school in Greece by the Near East Relief. These goats give three times as much milk as the Greek goats and they have a milking period of eleven months, instead of five months for the Greek goat. What kind of goats do you think these boys will have on *their* farms?

We are making discoveries and inventions as fast as ever, and are therefore learning new and better ways of doing things and making things. Therefore, many things make possible an increase in our agricultural output if there is a market for the goods.

1. Finding new crop plants. A plant explorer in the last quarter of a century brought to the United States the seeds of Sudan grass from the African grassland. Plant Sudan grass and in six weeks it may be a foot high, or even higher. A field that will pasture two cows, if planted to the well-known American blue grass, will feed five or six cows if planted to Sudan grass.

Another explorer brought back from Russia a kind of drought-resistant wheat called *durum* wheat. Millions of bushels of this wheat are now grown in places that are too dry to allow other kinds of wheat to be a dependable crop.

The nutritious Chinese persimmon, improved through many centuries by Oriental gardeners, has recently been introduced into Europe and America, where it has made many friends.

We mention these three new crops merely as examples of many more new crops already in use. Many, many more may be introduced if we need them and choose to find them.

2. Breeding new plants. "Macintosh" is the name of a variety of apple greatly liked in some parts of our country. In New York this apple ripens in October and will keep for three or four months. Plant breeders have crossed the Macintosh apple with yellow apples that ripen in July. The resulting new apple is red in color, looks and tastes like the Macintosh, but like its yellow parent it ripens in July. Plant breeders have made many crosses with the Macintosh and many new varieties of Macintosh-bred apples have appeared. These greatly resemble the parent Macintosh and ripen throughout the entire season. They can be had any day in the year.

Plant breeding is a process that may be applied to almost every kind of plant we now use, and many that we have not yet used. Plant breeders could doubtless double the number of crop plants, and they could also produce better strains than are now being used for most crops.

3. Breeding better animals. The animals

on our farms can be improved greatly by breeding from the best only. Here are two examples of that fact.

The Connecticut Experiment Station conducts an annual egg-laying contest. In 1921 the year's average was 161 eggs to a hen. In 1931 the year's average was 213 eggs to a hen.

In 1900, cows in the United States gave an average production of 3646 pounds of milk. By 1932 this had increased to 4302 pounds. There were, however, in the United States in 1932, 1431 dairy farmers whose cows averaged over 10,000 pounds of milk for each cow.

The importance of keeping good cows rather than poor ones is shown by the following record. One group of cows when tested had a poor record, the other group had a good record. The low-yielding cow eats nearly as much as a cow that gives much more milk, and she occupies just as much barn room. Record covers one year.

	Low-Yielding Cow	High-Yielding Cow
Average pounds of milk a cow	4005	9987
Butterfat	3.9%	4.0%
Average pounds of butterfat a cow a year	155	397
Price of butterfat a pound	40¢	40¢
Average feed cost a cow	$53	$85
Income a cow above cost of feed	?	?

Copy and complete the table above. Do it also at the price of 30 cents a pound for butterfat, and at 20 cents.

A pound of butterfat makes 1.17 pounds of butter.

4. Artificial fertilizer. For several hundred years Rome ruled all the countries around the Mediterranean Sea. Then Rome collapsed. Some careful students have said this happened because of soil exhaustion. Meanwhile, the farms in many parts of China continue to yield abundantly after three or four thousand years of use. This is because the people carry back to the fields all of the manure produced by both animals and men. Thus nearly everything that the field produces comes back to it. This maintains the fertility of the soil.

Fig. A. A promising kind of dry farming in central Tunisia. The rainfall is seven inches a year, producing the scattered shrub and small-bush vegetation of the hillsides. The Matmata tribe of Berbers build dams of loose stones and earth. When a rain comes, the gullies run and the dams fill with water and with sediment. Olive trees and date trees are planted in this sediment, so that they get this shower irrigation and make splendid olives (and mediocre dates). This device of a crop-yielding tree in a gully is capable of use in every continent and in many arid lands.

Fig. B. Strip cropping is saving the Wisconsin hill farm. Below the fence at the right the farmer has strips of clover, alfalfa, and corn. There is very little water run off and almost no soil loss. Above the fence is pasture where grass holds the earth. How is the land in the background being used?

Fig. C. This view in the Edwards Plateau of Texas shows the bushy pasture of dry lands that is to be found in six continents—one of the great landscapes.

Fig. A. Mass production of cow feed, also for beef cattle or sheep. Ensilage cutters chop up from 5 to 20 tons an hour of corn stalks, leaves and all, and blow it to the top of a silo 40 or 50 feet high. This gives 30 to 40 per cent more food than any other form of corn utilization does. It will keep for two years and tide over a drought the next year.

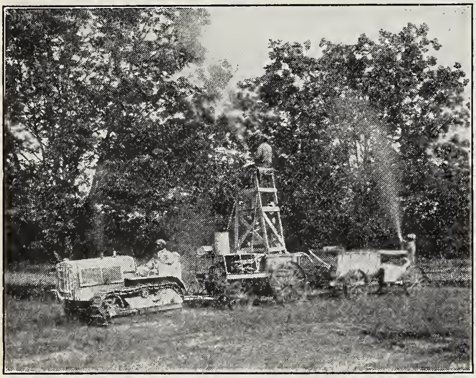


Fig. B. Two of the men in the picture are spraying and dusting pecan trees in order to kill insect pests which might otherwise destroy the crop.

During the last hundred years scientists have learned how to feed plants by using chemical fertilizers. As our bodies need protein, carbohydrate, and mineral salts, so plants need nitrogen, phosphate, and potash.

(*a*) *Nitrogen or nitrate.* Nitrate is the most costly and usually the most effective of the three main plant foods. Nitrate has been used for commercial fertilizer for only a few decades, but it has been used in manufacturing gunpowder for a long time. The small amount of nitrate that men in George Washington's time used was secured from bat manure that was found in caves. It is said that Napoleon ordered his people to raise pigeons so that the nitrogen from their droppings might be leached out and used in making gunpowder.

About 1840, when the desert islands off the coast of Peru were discovered, they were piled high with bird manure, left by millions of sea birds that had fed upon fish and lived and nested upon the islands for generations. This fertilizer, called Peruvian *guano*, produced good crops in Europe. But in a few decades the accumulation was exhausted. Then from the deserts of Chile nitrate of soda was brought. This supplied fields and factories of Europe and the United States with nitrate for about a half century. Then chemists learned how to make nitrate in factories by taking nitrogen from the air. Nitrate has therefore become cheaper and so food can be grown more cheaply.

(*b*) *Phosphorus.* Every plant and every animal must have phosphorus in its skeleton. In some parts of Africa the soil contains very little phosphorus. Therefore the plants contain very little phosphorus. It is reported that it takes a cow five years to mature, although she would mature in two years if well fed. Animal bones were the first source of phosphate used for commercial fertilizer.

The discovery of fossil phosphate—phosphate rock—gave us the first cheap supply of phosphorus. Phosphate rock is quarried in Florida by the thousands of tons. It is sent to every important port of the United States, and overseas by the shipload. Some goes to Cuba, China, and Japan. Fortunately, we have large stores of fossil phosphate, the greatest being situated in and near the northwest corner of Colorado.

(*c*) *Potash.* If plants do not have pot-

ash, their stems are weak, the plant breaks down, the leaves blight. There is some potash in the water of certain lakes of California and Nebraska and in the deep-sea water, but we cannot obtain it in useful quantities. In times long past whole beds of potash were laid down and covered up in the rocks as coal is covered. The greatest of these deposits are in Germany and in the French department of Alsace. Important deposits have recently been discovered in Spain. Our present supply of potash is imported, although there is a large field in west Texas and New Mexico which may prove to be rich enough to give us our own supply.

(*d*) *What fertilizer does.* Fertilizer can double, even more than double, the yield of crops on many farms. In some sections of Pennsylvania and other states there are clubs of farmers who grow 400 bushels of potatoes to the acre. What is the national average? (Page 356.) These men use more than half a ton of fertilizer to an acre.

5. *New lands ready for the plow but not used.* There are three large areas of good unused farm land awaiting the plow. The largest is in the black-soil belt of Siberia. There is much unused land in western United States and western Canada. Manchuria is the third area. If these lands and the other good farm lands of the world should be used as carefully and as intensively as are the lands of Belgium and Denmark, we could produce two or three times as much food as now enters into world commerce.

6. *New lands by drainage.* There are millions of acres of land in the United States that can be made ready for the farm by digging ditches to carry off the water (Fig. 197-A). The largest area of this type is the Mississippi flood plain, but marshes left by the glaciers in northern United States also give us much room for new fields if we should need them.

The work of the Dutch in turning sea bottom into farms shows what some men can do when their country needs more land.

Fig. A. If land is perfectly flat, water stays so near the surface after rains that it is often impossible to cultivate the crops. With porous earthenware pipe like this in the bottom of a ditch the water runs quickly away. Millions of acres of land may be made tillable by draining. See Figure 120-A.

Every continent except Australia has large areas of land that can be reclaimed by drainage.

7. *New land by irrigation.* The recent opening of the Lloyd Barrage, on the Indus River in northwestern India, and the Boulder Dam now being built on the Colorado River in Arizona, show what can be done by two types of irrigation enterprise—diversion of a great river and building of a great reservoir. Every continent can reclaim some land by irrigation; America and Asia can reclaim a great deal.

8. *A tree-crop agriculture.* You have already learned that men have recently planted certain tropical trees in places which were previously only a tangled forest. Land where only monkeys chattered, parrots screamed, and insects buzzed now send out shiploads of cacao, coconuts, palm nuts and palm oil, ivory nuts, Brazil nuts, and rubber. Many more trees are waiting in the tropic forest to be made into crops.

In our own country we have made a crop of the wild pecan recently and are in proc-

Fig. A. One of the great landscapes of the world. The coconut palms, the banana plants, the mango tree in the background, the house of thatch and bamboo beside the quiet water, might be in Central America, Mexico, Trinidad, Panama, Ecuador, Guiana, West Africa, East Africa, Madagascar, Indochina, Malaya, or any one of a hundred East Indian islands. It *is* a farm and artificial fish pond in Java.

ess of making crops of native walnuts and hickory nuts.

Waiting for experimentation is the honey locust, a tree good for timber and yielding heavy crops of long beans (Fig. 153-A). Honey-locust beans might become a crop for millions of acres of hill lands, whose soil is now washing away but would be held in place if trees were planted there.

This kind of new tree-crop agriculture has great possibilities in every continent. Millions of acres of hillsides and mountain sides might have some such crop as the chestnut orchards of Corsica. Many of the poor grasslands of the world might become several times as productive as they now are (Fig. 195-A).

9. Air conditioning in the tropics. We know that the climates of parts of Europe and central North America are much more healthful and make people more energetic than do the climates of some tropic lands with their continuous heat and bothersome insects. We are now about to change this climate—almost.

We have long kept our *food* in refrigerators. Refrigerator cars and ships have completely changed the *trade* in bananas, milk, butter, and meat. We have now begun to condition the air of buildings where *people* live. If we find that we want the temperature and the moisture to be like those of London or Tokyo or Chicago or some other place, we can make them so. It may bring great changes to the world's agriculture if a colony of Scotchmen or Danes or Americans can live in a big cool house with many apartments and recreation rooms on the banks of the Amazon. Their wives and little children would spend most of the time indoors in a climate such as the people choose to make by pushing electric buttons to cool or dry or moisten the air or to make a breeze.

The real problem. Man's chief problem with agriculture at the present time in the United States and Europe is not how to produce more, but how to arrange things so that people may have the money to buy agricultural produce. Many governments are working earnestly at this difficult task. When more people have more money to spend there will be a great increase in demand for farm produce. More produce can be used when more can be paid for.

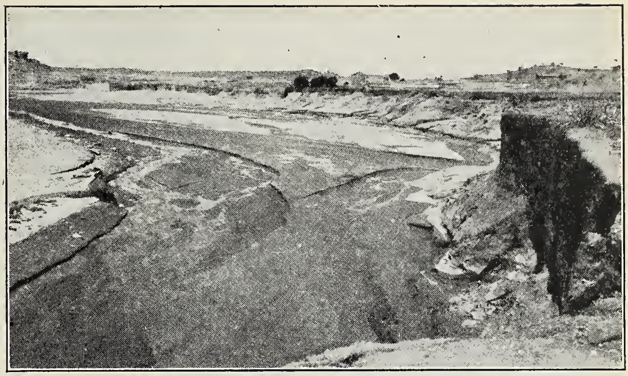


Fig. A. An Arizona stream. When this picture was taken, a man stood by who remembered the time when there was no stream there, but a wide, open valley covered with grass and shrubs, over which a little water flowed occasionally in times of heavy rain. Over-pasturing where the stream is and on the hills far away brought this great cutting and removal of earth—all in a part of the lifetime of one man. Find out what the United States Erosion Service, Washington, D. C., and your own state agricultural experiment station are doing about erosion.

THINGS TO DO AND QUESTIONS TO ANSWER

Prove or disprove. Prove or disprove the statement at the beginning of the unit.

Can you answer these? 1. How can new varieties of plants be secured?

2. Where are the largest areas of unused farm land? If this land were used up in a short time, how would it affect world commerce?

3. How can tree crops increase the usefulness of land?

4. Of what value are nitrate, phosphorus, and potash? How is each secured?

5. How many new crops are mentioned in this unit? Can you think of any others?

6. Tell the story of our changing supplies of nitrate and its effect on the food supply.

Some things to think about. 1. What do I mean by "the real problem"?

2. What parts of the world have arid lands with mountains, plains, and climate much like the arid lands of southwestern United States? Examine Figure 2-A.

3. What will modern machinery do for the Oriental farmer? improvements in plants and stock?

4. Make a cross-section drawing that shows how the ditch (Fig. 197-A) works.

Extra credit. 1. Find out what the Dutch people have recently done to get more land.

2. What the Tennessee Valley Authority, Knoxville, Tenn., has learned about soil destruction in their valley and its plans to stop it.

3. What Figure 198-A has to do with air conditioning.

UNIT 3—SOME DANGERS THAT THREATEN FARMING IN THE UNITED STATES

How Long Does Land Last? Many localities near the Mediterranean Sea had much more good farm land and more people in Roman times than they do now. How do you explain this change? Does it have a lesson for the United States, and what is that lesson?

The insect menace. The new things about agriculture are not all good. We have introduced foreign plants and we buy the produce of all continents. With these foreign things have come some of the weeds, insects, and plant diseases of foreign lands. Plant diseases and insects are unwelcome immigrants, but we cannot deport *them.*

About the time of the Revolutionary War there came from Germany an insect called the Hessian fly, which lives in the wheat plant. If wheat is sown as early in the autumn as many farmers would like to sow it, this insect, happy in the warm weather, will almost ruin the plant.

The hundreds of millions of dollars of damage done by the cotton boll weevil is already familiar to the readers of this book.

In tropic countries the termite, or white

Fig. A. The Redding Farm. See Figure 201-A to learn what happened to it. This farm once had the reputation of being the best upland farm in Muskingum County, Ohio. Now it is destroyed; it cannot be restored. Only one acre (No. 1) has the original topsoil intact, although four additional acres (No. 2) have some of the original soil left. Fifty and one-half acres have lost *soil*, *subsoil*, and *substratum shale* to depths varying from 2 to 30 feet. The farmer grew corn continuously. He would not rotate or grow clover.

ant, a small insect that lives in the ground out of sight, eats up a fallen tree in a few months. The white ant will also crawl into the foundations of a wooden house, and before anyone knows he is there, he may have eaten underneath until the floor is a mere shell. You may fall through when you step upon it. We thought that the termite liked only hot climates, but it seems that he was not in the United States only because he had not been introduced. We have recently discovered to our horror that he is at work in New York City, and in certain parts of the South. Nothing now known or likely to be known can stop the white ant, and he will probably spread to many parts of the United States.

Insects are arriving at an alarming rate. While we can check some of them by fighting, we cannot defeat them. Bulletins can be had from the United States Department of Agriculture that tell about all these insects, and about the grasshopper, chinch bug, cotton boll weevil, Japanese beetle, codling moth, and the European corn borer.

Soil. If you should dig a hole two feet deep in a field somewhere in the eastern half of the United States where a fine crop is growing, you would probably find that the first 6, 8, or 10 inches of ground were dark in color, while deeper down the soil was lighter in color and of coarser material. The dark top part is called the *soil;* the lower, lighter, coarser part, the *subsoil.*

We might say that the soil is both a forest and a city, for every cubic foot of it teems with millions of little plants called bacteria, and also with great numbers of tiny animals. These organisms break the soil into finer particles and make chemical changes of which we know but little except that they make the soil a good place for plants to feed.

Sometimes it takes a thousand years for Nature to break up stone and make a layer of soil a foot deep. The life of the human race depends upon this soil. If the soil goes, man must also go. How are we taking care of soil in the United States?

Soil dangers in America. When the European farmers came to this country, they found four new things: corn, cotton, tobacco, and the heavy downpour of the summer storms. These four new things are both good and bad. In Europe the crops had been and still are mostly grasses and the small grains like wheat and barley, which, because they stand close together, hold the earth in place (Fig. 193-C).

I crisscrossed England from east to west and from north to south, in an automobile, and saw only one gully. I rode from København to the top of the Alps and saw not a single gully.

Corn, cotton, and tobacco are not like wheat, barley, and clover in their effect on the land. Corn, cotton, and tobacco plants stand far apart in the field. Several times during the growing season the soil around these plants is loosened with cultivators (Fig. 79-A). Then comes ruin if the land is sloping—the thundershower washes the soil away. To see what these facts really mean, let us examine carefully the following table, which gives the results of a rain-

storm on one of the United States Government's experiment stations. It is on loess (wind-made) soil, one of the very finest soils in all the world.

UPPER MISSISSIPPI VALLEY EROSION EXPERIMENT STATION, LA CROSSE, WISCONSIN

Slope of ground, 16 per cent.
Rainfall 3.35 inches, June 30–July 1, 1933.

PLOT NO.	CROP	PER CENT OF TOTAL RAINFALL THAT RAN OFF	TONS OF SOIL REMOVED PER ACRE
2	Corn	26.8	39.0
4	Barley	30.5	1.4
6	Clover	1.7	0.1
10	Grass	0.0	0.0

Rainfall, 1.15 inches June 30, fell slowly, no runoff; 2.20 inches 18 hours later, hard shower.

How much rainfall ran off from the grass plot? the clover plot? the barley plot? How much soil was lost from each?

Each year we plant in this country about 150 million acres of corn, cotton, and tobacco. Each year 3000 million tons of soil are washed out of our fields and from our over-grazed land (Fig. 201-A).

In the state of Illinois alone a recent survey shows that 3,000,000 acres of previously good land are gullied until they are fit only for timber; 3,000,000 more are fit only for pasture, and 12,000,000 are rapidly approaching the gully stage. Careful investigation in the Tennessee Valley this year showed that many farmers are continuing to clear and plant to corn and tobacco steep slopes—some slopes have a slant of 82 per cent. Farmers expect to abandon the land after five to seven years. What a dreadful loss to our country results when farmers do not use a type of agriculture that suits the land!

Surveys and plans. We did not know how destructive corn, cotton, and tobacco were to our hill lands until we began to measure the destruction. The Tennessee Valley Authority has found that in a hundred years we have already ruined and abandoned about half of the farm land in the beautiful Tennessee Valley. Now you see why this new aid to industry—the

Fig. A. Map of the Redding Farm.

1—No erosion, 10-12 in. dark top layer intact (level upland).
2—Slight sheet erosion, 3-4 in. topsoil removed (comparatively level upland).
3—4-8 in. topsoil lost by sheet erosion (moderate slopes).
4—8-12 in. removed, all surface soil gone and part of subsurface layer (moderate slopes).
5—12-18 in. removed, all surface soil and 6 in. of subsoil gone (moderate slopes, somewhat steeper than No. 4).
7—2-3 ft. soil and subsoil removed (moderately steep).
8—3-5 ft. soil and subsoil removed—severe sheet erosion followed by gullying (steep).
8R—Reforested after cultivation and abandonment. Same disastrously eroded condition as No. 8, but has about 2 in. of leaf-litter on surface (steep).
9—5-30 ft. soil, subsoil, and underlying soft shale rock lost by erosion, severe gullying. Land permanently destroyed.
10—Flat alluvial soil, timbered. Much soil and subsoil material washed from slopes above deposited over this bottom land, making it poorer than it originally was.

Tennessee Valley Authority—is making plans to save the remainder of the valley.

THINGS TO DO AND QUESTIONS TO ANSWER

Did you read carefully enough to: 1. Explain the difference between soil and subsoil?

2. Name six of our insect pests?

3. Tell about a farmer you would or would not wish to have as a grandfather?

Explain. Explain why United States farmers have been so careless in caring for their soil. Make a list of the things that have brought this about under the following headings: Machine age. Type of crops. Amount of soil. Contrast this with the European farmer.

For extra work. Write to the United States Department of Agriculture:

1. To secure information on the insects mentioned in this unit.

2. To secure information about soil erosion and its prevention. When you have finished with the

Fig. A. It is a skilful job to hitch up and drive all these big helpers, and how they do eat between seasons! Each horse eats about fifteen pounds of grain and fifteen pounds of hay a day. Their work is now being done largely by tractors in many places (Fig. 58-A). What does this tell about the future of agriculture?

material, give it to the librarian so that it can be filed to be used later.

CHAPTER SUMMARY

Big ideas. State briefly the important big ideas in this chapter. Give some facts to show the importance of each of these big ideas now or in the future. If possible, find a picture in this book or elsewhere that illustrates each big idea.

New words: inefficient, forage, decades, nutritious, collapsed, abundantly, guano, gullied, and erosion. Use each in a sentence.

Some important arithmetic. 1. An acre of subsoil one inch deep weighs 140 tons. How long would the top foot of the cornfield last on the Wisconsin soil-experiment station field if it received six such rains per year as destructive as the one mentioned on page 201?

2. How do the acres of soil already destroyed or injured compare with our total cropland of 350,000,000 acres, or the total area of such countries as the Netherlands, Denmark, England?

3. How long would our 350,000,000 cultivated acres last if we destroyed in each hundred years as much as we have already destroyed?

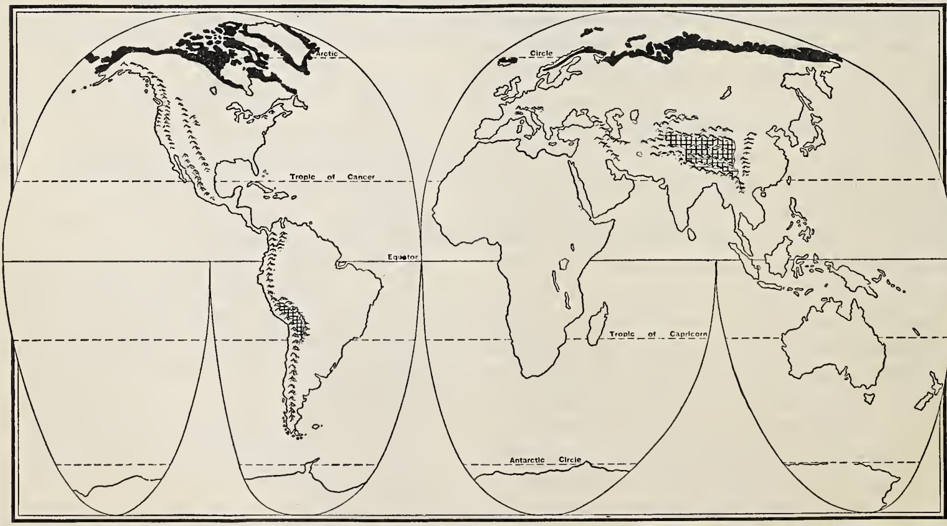


Fig. A. The solid black areas on this map show lands with tundra type of climate. The areas with crossed lines are high plateaus where the vegetation resembles that of the tundra. See these areas also in Figure 2-A.

Fig. A. Some of the cave men about whom you will read in this chapter.

CHAPTER XX

MAN BECOMES A MANUFACTURER

UNIT 1—PRIMITIVE MAN AS A MANUFACTURER

A PROBLEM IN RECONSTRUCTION. What would happen if the people of the world could keep food, clothes, and houses, but lost every knife, every machine, every tool, every wheel, every piece of harness, paper, pencil—everything except their two hands?

The first tools. The anthropologist sometimes finds ashes, charcoal, arrowheads, stone axes, cutting flints, bones, shells, crude pictures, and human skeletons deep under the surface of the earth on the floors of caves. From them he pieces together facts about prehistoric man, somewhat as a hunter tracks game.

Food-gathering man lived upon the earth for a long period of time with only very simple tools. When he wanted to cut something, he used a piece of flint chipped to form a rude knife or ax. He used flint also for arrowheads. He made needles of pieces of bone. For thread he used the sinews of animals or strips of skin. He wove blankets of strips of rabbit skin as some Canadian Indians do to this day. He made baskets. He twisted fibers and made thread. He made a simple loom. He crushed grain and other seeds in a wooden mortar or between two stones. Very early indeed man learned to tan leather and to bind it across the section of a hollow log, thus making a drum. With an ax of flint or stone and with fire he hollowed out a log and thus made a boat. Most important of all single inventions, ancient man learned to make fire (Fig. 203-B).

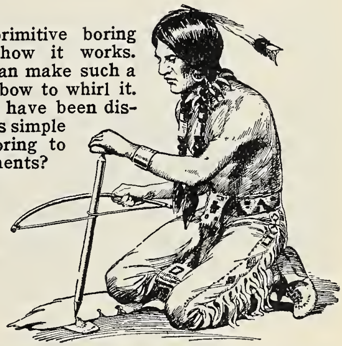
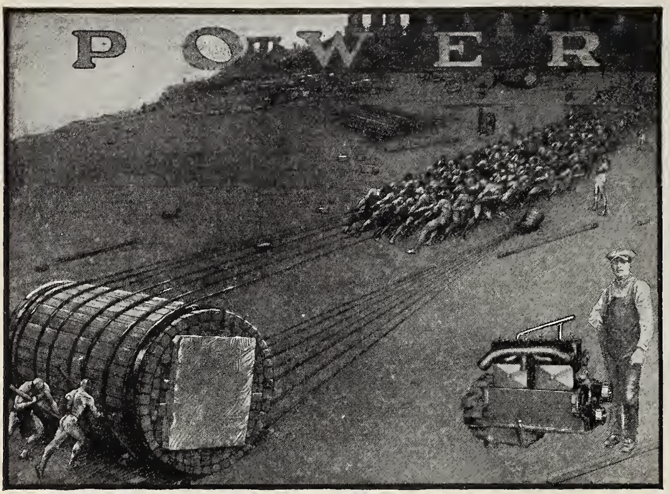


Fig. B. A primitive boring stick. Tell how it works. Possibly you can make such a stick with a bow to whirl it. How may fire have been discovered by this simple process of boring to make ornaments?

With the aid of such simple manufactures, and without beasts of burden, man lived for a long, long time in several continents.

Think it through. List the things that tools, mentioned on this page, can make.



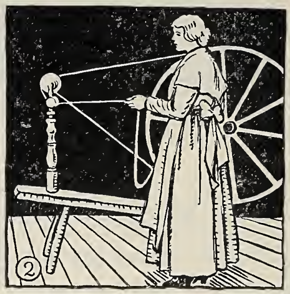


Fig. A. The little automobile motor, with one man to feed it gasoline and oil, can do more work with a few gallons of gasoline than can all these men working as the ancients did. What are the men doing?

Figs. B-C. The drawings at the right illustrate domestic manufacturing: 1, carding wool; 2, spinning wool.

UNIT 2—THE HOUSEHOLD EPOCH AND EARLY CIVILIZATIONS

A Comparison. In what respects did the times of George Washington and of Cheops (who built the first pyramid) differ in the ways of doing business? of manufacturing?

Early empires. In Egypt, Iraq, the Indus River Valley, and other places in Asia the ruins of great buildings still stand.

These great structures became possible only after man had the help of beasts of burden. The animals pulled the plow, the harrow, and the wagon; they trod out the grain; they furnished meat, milk, wool, and skins. The labor and the food which animals supplied made a great change in the manner in which man lived. With these helps man could produce his food in a part of the year and have the rest of the year for making buildings and books.

The era of domestic manufacturing. Animals were important in that era, but chiefly through giving food and raw materials. Animals gave little help to man at that time with *manufacturing*.

For several thousand years almost all manufactured things were made with the aid of human strength. With foot or hand the people turned the spinning wheel and worked the loom, made clothes, shoes, soap, candles, bricks, tanned leather, worked the bellows of the forge, and hammered iron. If the carpenter had a lathe, he turned it with his foot. Thus worked the subjects of Cheops, builder of pyramids, and most of the people who knew George Washington.

During all of this period the only assistance man had other than muscle was that of sailboats, and windmills, and water mills. These small mills (Fig. 302-B) were very important indeed in West Europe and in America in the era of domestic manufacturing.

The word "manufacture" meant originally making things by hand. The word now means using hand or machines, mostly machines, for making things.

Your answer. 1. Have your answer ready for the problem at the beginning of this unit. Compare it with other answers.

2. What articles are now manufactured at home?

Bulletin board. Make an exhibit of pictures of early man's first tools; man's latest tools.

UNIT 3—THE INDUSTRIAL REVOLUTION

A RECORD OF CHANGE. How might you prove that, in one way, it was a longer period of history from George Washington to the present time than from Cheops to George Washington?

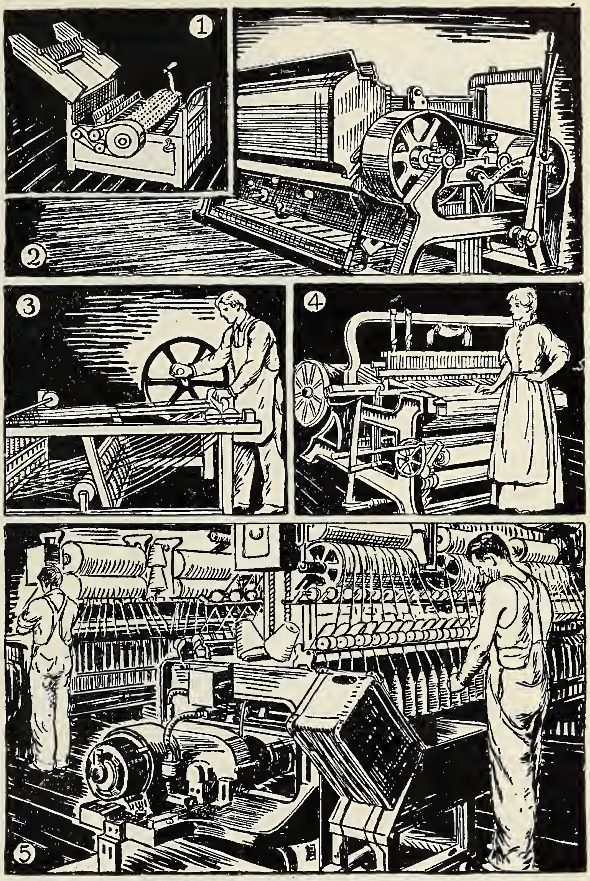


Fig. A. Steps in the industrial revolution: 1, Whitney's cotton gin; 2, a modern cotton gin; 3, Hargreaves' spinning jenny; 4, an early loom; 5, cotton being spun and wound on bobbins in a modern cotton mill.

The steam engine. A Greek named Hero made a little steam engine more than 2000 years ago. The engine spun rapidly around, but it remained only an interesting toy for more than two thousand years. In 1765, James Watt, an Englishman, made an engine that put the power of expanding steam to work and made it pump water and lift coal from coal mines.

Other machines. When the engine began to turn wheels, man began to find new ways of using this power, and some of the great inventions of the world were made.

1. John Kay, an Englishman, invented the flying shuttle in 1738. By means of this invention *machinery*, instead of the hand, could send the shuttle carrying thread across the loom to make cloth.

2. Between 1764 and 1767, John Hargreaves, an Englishman, invented the spinning jenny which enabled a spinner to make more than one thread at a time.

3. The cotton gin was invented in 1793 by Eli Whitney of Connecticut. It made cotton cheaper.

4. In 1846, Elias Howe, an American, made the sewing machine.

These four inventions, and the wide use of the steam engine, made clothing cheaper.

Another series of inventions has changed and cheapened the manufacture of almost every product. Later inventions which were of special importance were the dynamo, Michael Faraday (English) 1831, perfected by Thomas Edison (American) 1878; and transmission of power by wire, 1882, when Edison established in New York the first central power station in the world.

Rearranging men. The steam engine has caused the human race to be rearranged. In George Washington's time men made yarn and cloth, shoes and hats, guns and knives, harness and wagons, at work benches in their own homes on the farms or in little shops by the roadside. The engine sent the workers to the factory, where a single engine ran many machines. Towns grew up around the factories, factories grew up near the coal fields, and the little work shops on the farm lands became idle and decayed.

Fig. A. Howe's first sewing machine was little more than a foot high and the wheel was turned by hand.

The period of hand industry had been very long. The period of factory industry has been short.

Cities grew. The steamboat and the locomotive came soon after the steam-driven factory became established. Food and raw materials could then be brought from great distances. Therefore cities could grow.

Then came the telephone, the telegraph, the electric motor, and the electric power line to carry power from the central power plant or the distant waterfall to the homes and factories of the town or country. Because power can be transmitted, people can again have machines in their homes, and in small towns as well as in cities. In America there are engines and water wheels that have many times as much power (strength) as all the people in the country.

More machines. At the present time there are many schools of engineering, many laboratories where people study mechanical and industrial problems, many inventors trying to make better machines. These activities have resulted in thousands of different machines having been made. Machines can now do most kinds of work. Moreover, many automatic machines have been made. An automatic machine runs without constant attention from anyone. Thus, we can put the end of a roll of wire into a machine, and the machine will give us back kegs of nails. There are hundreds of different types of automatic machines.

Standardization and mass production. The automatic machine makes articles that are alike. Thus, a certain part of an automobile, or a typewriter, or a phonograph, is like thousands of other parts made from the same pattern. When a part of a machine is broken or worn out, the part can be replaced by one of these new *standard interchangeable parts.* Thus we can repair a modern machine simply by ordering a *standard part* from the agency and having it put in place by a semi-skilled mechanic. You can readily understand why the present time is called the *age of machinery.*

Capital and capital goods. The coming of machinery, standardization, and interchangeable parts has made a great change in the amount of capital and capital goods necessary to start a manufacturing industry. Years ago the wagons used in the country were made by the wheelwright, a worker in wood who had his shop alongside a blacksmith who did the iron work on the wagon. With a few hand tools the two of them made a wagon complete. Now an efficient wagon factory has power-driven lathes, boring machines, saws, planers, drills, and many other machines. These are called *capital goods,* and before the factory can start it takes a lot of cash capital to buy them, and to build a large building to hold them.

THINGS TO DO AND QUESTIONS TO ANSWER

Explain. 1. Changes in making clothing.

2. What is meant by "automatic," "standardization," and "interchangeable" parts? Give illustrations.

3. Why the invention of power-driven machinery has led to the development of large cities.

For extra credit. Hero did his work at the University of Alexandria. Find material about this early university and tell it to the class.

UNIT 4—THE NEEDS OF EVERY INDUSTRY

RESOURCES. What does a neighborhood need if it is to become a manufacturing town?

The manufacturing town. We know that a man needs certain foods to keep his body healthy; likewise, a factory needs certain things in order to thrive and become part of a great industry. Let us list the needs of a factory or a manufacturing industry, or a manufacturing town.

(*a*) *Laborers.* There may be automatic machines, but there must also be some laborers, both skilled and unskilled, and some of the workers must be intelligent.

(*b*) *Climate.* If the climate of a region enables men to be healthy and energetic, that is a good place for a factory. Where the workers are exhausted by heat or stupefied by too much cold, is a poor location for manufacturing.

(*c*) *Education.* The workers in a factory will do better work if their minds and hands are trained in good schools.

(*d*) *Managers.* Someone must buy and sell, inspect, make plans, and supervise the works. This is a difficult task, and every factory needs skilled managers.

(*e*) *Inventors.* Improvements are constantly being made in machinery; therefore, inventors who do this creative work are necessary to successful industry.

(*f*) *Power.* Every industry needs more power than man's muscles can supply. Therefore, a factory needs to be within reach of waterfalls, or where coal or some other source of power is cheap.

(*g*) *Raw materials.* Every manufactured product requires raw materials; therefore, a factory must be located where the necessary materials can be secured cheaply.

(*h*) *Capital.* Suppose the factory owner wishes to enlarge his plant. Money is needed to pay for additions and new machinery. If people have money to invest, the factory may grow. Money for investment often passes from one country to another. Many of the larger American companies now have branch factories in foreign lands.

(*i*) *Market.* Who will buy the things the factory makes? If there are enough buyers, the factory and its town may prosper.

(*j*) *Good transportation.* Make your own list of the ways in which transportation is necessary in a manufacturing town.

(*k*) *Good government.* In a manufacturing town, as in every other place where people live, laws are needed to regulate the conduct of the people. A good police system should keep order. Just courts are necessary to settle disputes. For several years factories have not been built in most parts of China partly because of the fear that some army will take possession.

Studying the industries. We need to keep these things in mind as we study the great industries of many countries and the great commodities in world trade. As we continue our study of manufacturing industries and the reasons for their locations, we shall turn often to this very important list of the needs of every industry.

THINGS TO DO AND THINK ABOUT

Choosing a manufacturing town. 1. Make a list of the needs of a manufacturing town.

2. By using the requirements stated in Unit 4, explain the advantages and disadvantages of: Pittsburgh, Pennsylvania; Churchill, Canada; Chicago, Illinois; the town that you know best.

CHAPTER SUMMARY

Find the meanings of the following words: anthropologist; prehistoric; sinew; invention; bellows; forge and lathe; capital goods. Tell what capital goods are in your neighborhood.

A population graph. In Washington's day, 3 per cent of the people in the United States lived in large cities. Today about 50 per cent of the people live in large cities. Show this on a chart. Explain what caused this shift of population.

Think these through. 1. List in the order of their value to man four kinds of power. Does the class agree with your order?

2. If you knew you were to be cast ashore to live for a time on an island like that of Robinson Crusoe's, what five things that our modern world can give would you choose to take with you?

Topics for special reports. The Steam Engine; the Cotton Gin; Life of Primitive Man; Era of Domestic Manufacturing.

Fig. A. Steps in the making of steel: 1, white-hot steel pouring from a furnace; 2, pouring the steel into a mold; 3, rolling steel. A block of hot metal passes between the rollers and is flattened into sheets.

CHAPTER XXI

THE MANUFACTURER NEEDS EARTH MATERIALS

PRODUCTS WE CANNOT DO WITHOUT

A Correct Name. Can you find a better name for mining than "The Robber Industry"? Compare it with grass, grain, forest in writing the reasons for your answer.

The first and last manufacturer. Man does not make anything in factories without in some way using minerals—earth materials. The earliest manufacturer probably used flint. In talking about ancient times we speak about the Stone Age, the Bronze Age, and the Iron Age. By these names we mean that, for a time, stone was the *earth material* most useful to man, then bronze, then iron. The present age is often called the Age of Steel. We have learned to make steel by mass production. Steel is made entirely by machinery and nearly all machinery is made of metal.

Uses and qualities of metals. Metals give man great power. The European people who settled this country had guns, knives, and metal tools. These possessions gave the settlers power over the Indians and enabled them to take the land of the Indians. The nations that use the most metal are the richest and most powerful nations.

Nearly all of the metals can be melted and poured into molds in which they harden and take the shape of the mold. The number of *nonmetallic* minerals is much greater than the number of metals.

Mixtures of metals are called *alloys*. Bronze is an alloy made of copper and tin. Alloys often have qualities unlike those of any other metal and they are *very* useful (page 212).

The formation of ores. Gold, silver, iron, copper, and other metals are distributed through many rocks of the earth somewhat as a little sugar and salt are mixed through a loaf of bread. In certain places more metal has accumulated and we call rocks containing these metals *ores*. Iron ore is found in some places. In other places copper ore, gold ore, and other ores are found.

Very little ore is found in rocks that remain in the undisturbed layers in which they were laid down. Most ores were formed deep down under the surface of the earth. Great forces twisted and cracked the rocks and bent them into mountains. Far down under the surface of the earth rocks are hot. Water soaking through the stones and running through the cracks in the broken layers becomes heated. The hot water dissolves very small quantities of metal and sometimes deposits this metal,

or rock very rich in metal, along the sides of the cracks. These deposits we call *ore veins*.

Millions of years after the ores are formed, the mountains above them may be worn away by erosion. The ores are then on the surface. Thus the Upper Lakes region of Michigan, Wisconsin, Minnesota, and Ontario, and many other parts of the world, now have at the surface of the earth material that was once thousands of feet underground. If the mineral deposits are near the surface, man may find them by examining the rocks that lie on top of the ground.

Prospecting. Hundreds of men are still hunting metals (prospecting), from Mexico to the Arctic Ocean and elsewhere. Many prospectors are skilled geologists who have spent years learning how rocks were made and arranged in the earth's crust. Of late, prospectors have gone by airplane into the Canadian forests and other remote and roadless places. Planes carry them quickly to places which they could otherwise reach only by weeks of arduous marching through woods and swamps.

Developing an ore deposit. Small quantities of ore—the very richest ore—can sometimes be dug out with pick and shovel. Sometimes ore is obtained by removing the earth and rock above it. This kind of mining is called *stripping*. Sometimes the ore deposit is a great mass like some of the iron ores of the Lake Superior region. After the stripping is done, the ore can be shoveled out of an open pit—*open-pit mining*. Most of the world's ores, however, are in small masses, often deep in the earth. They can be reached only by digging deep holes called *shafts*. Some shafts have now become a mile deep, or even deeper. Other shafts reach out from the vertical shafts and extend several miles under the earth.

Fig. A. These coins of several of the early Roman emperors show one of the early uses of metal.

Machinery in mining. A deep shaft mine requires engines for operating elevators to lift ore and waste rock, to carry men up and down, to pump water out of the mine, and to pump air into the mine in order to ventilate it.

Getting metal from the ore. In large buildings, called *concentrators*, the richer ore is separated from the useless rock by the aid of much expensive machinery. The ore that remains is called *concentrate*. Sometimes it is concentrated by roasting. Concentration leaves much less material to carry and to purify. Sometimes the concentrates must be carried on the backs of mules, donkeys, llamas, or oxen over rough mountain roads to a railroad station or to a plant for further working. The metal is finally separated from the waste by two main processes. One process is called *smelting*.

In a smelter the ore is heated in a very hot furnace until the metal melts and runs out. The waste (slag or refuse) melts and runs out at a different place. By the other process, the ore is crushed and soaked in chemicals to dissolve the metals. This process often requires large buildings with tanks and much machinery (Fig. 217-B).

Risks in mining. The business of mining is full of risks. Prospecting is risky. Most prospectors spend their lives without finding more than enough to keep them alive, sometimes even less. Working in the mine is risky. Rock often falls on the miner, and there are many other accidents that rob him of limbs or life.

Mining is risky for the investor who furnishes the money to develop and start

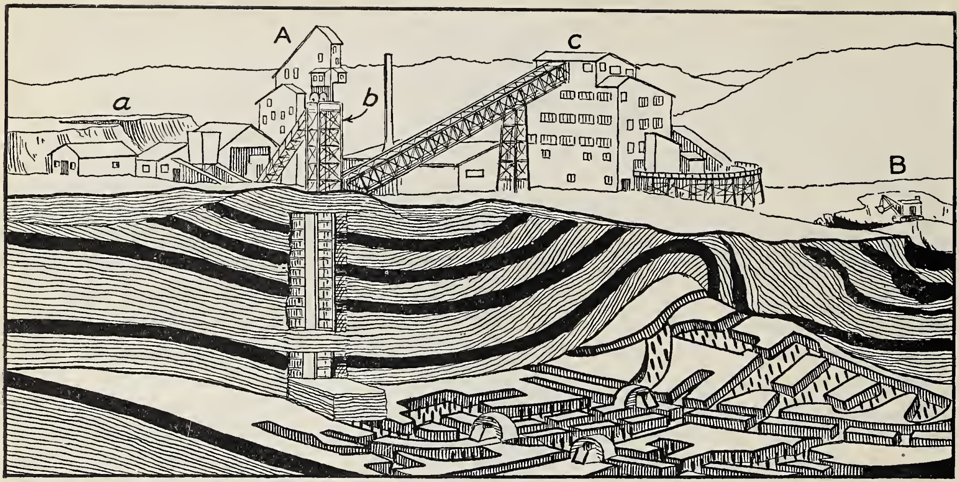


Fig. A. Mining coal. A, shaft mining. The shaft, as you see, passes through 5 veins (strata) of coal. In the lowest stratum the coal is being removed. See the tunnels, rooms, and roof props. *a* is a culm pile; *b*, the shaft elevator; and *c*, a breaker. At B the coal vein is on the surface and is being mined by use of a steam shovel.

the mine. I know an English gentleman who went to bed one night a rich man. In the morning he was bankrupt. His coal mine in Wales extended under the sea. The sea broke in and flooded the mine and ruined it. The same thing happened to a great gold mine near Juneau, Alaska.

In 1932 many American mines which contained much copper were shut down and thousands of workmen were unemployed because the world's copper market was being supplied by ore from the mines in the Belgian Congo worked by African Negroes who were being paid only a few cents a day. The American mines could not pay good wages and also sell copper at the low price of copper from the Belgian Congo.

The golden age of metals. We have more metal now than we are ever likely to have again. We are just learning how to get the metals. In a short time tin, copper, and lead will probably become scarcer, especially tin, of which there is but little. Our use of metals has increased very rapidly since we entered the age of machinery.

Conservation. Conservation of resources means using resources in the most *economical way*—and for *necessary purposes*—using them so as not to rob the people who come after us. We are now using our scanty supply of lead in making tubes for soap, cosmetics, shoe blacking, all of which might almost as well be kept in glass, which is made of sand. The supply of sand is limitless. Our scanty supply of zinc is going for metal roofing, for which we might use shingles and raise more trees, or tar, of which we have great quantities as long as we have coal. We use millions of tin cans to contain food that might just as well be kept in glass or in dehydrated form in paraffin paper. Tin foil for candy and cigarettes is a needless waste of a valuable metal. The supply will not last long at the present rate of use.

Will the future regard this period as one of *progress*, or as one of *waste* that robbed their generations of good things?

CHAPTER SUMMARY

Big ideas. Be ready to write briefly the big ideas in this chapter, and then make a talk on each.

Important facts. Make a list of the important facts which you have learned from your study of this chapter.

Graphs. Make some important graphs about mining from figures in the Appendix.

Library work. What material can you find on the famous "gold rushes" of:

(a) '49 to California; 1897 to the Klondike?
(b) Australia, South Africa, and Canada?

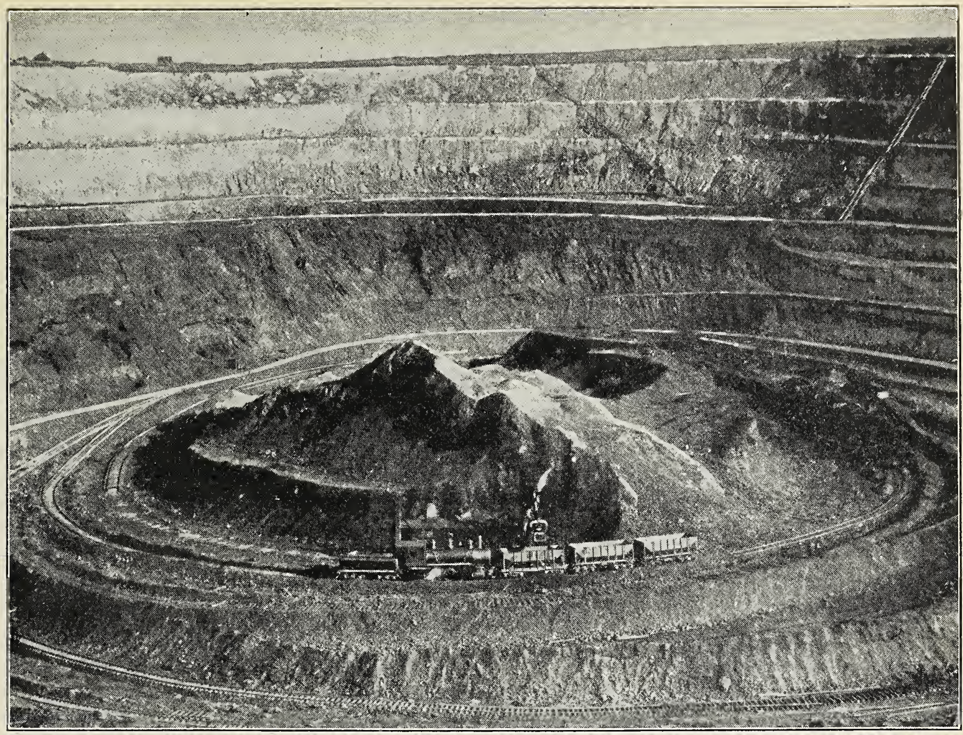


Fig. A. An open-pit iron mine in Minnesota. The big steam shovel is scooping up the soft earth-like iron ore and dropping it into the gondola cars to be whisked away to the steel mills. How does the train get out of the pit?

CHAPTER XXII

IRON AND STEEL

UNIT 1—EARLY IRON MAKING

A Choice. Is gold or iron the most precious metal in an age of machinery? Explain your answer.

Primitive iron, but good. In an African village two Negroes squatted beside a little charcoal fire. Each had under him a goatskin sewed and tied so that it became an air-tight bag with one small opening to admit air. The goatskin bag filled with air when one side was lifted. Then a bare heel closed the opening, a bare foot pressed the bag, and air rushed out through a reed and fanned the fire. The two bags, or foot *bellows*, kept a constant stream of air on the fire. The fire melted a few lumps of rich iron ore into a precious lump of iron. The method was *primitive*, but the *iron* was good, as good as that which any furnace in Pittsburgh makes today. But think of the cost in hours of work for a pound of iron!

Iron ore and limestone. If you will put a few lumps of rich iron ore on a charcoal fire, fan the fire briskly, and add a few bits of limestone, you can make a little iron. The limestone causes the ore to melt at a lower temperature. This simple process was discovered in many parts of the world and practiced for no one knows how long.

Some iron is found in almost every clay bank. A little is dissolved in every rain. If water with iron in it comes in contact with limestone, the water drops some of the iron, thus making ore deposits beside

limestone. Since limestone rock is widely distributed, iron ore is found in more places than any other important ore, but many of the deposits are very small.

Iron rust is formed when the oxygen of the air unites with the iron. Iron rust is iron oxide and is much like some iron ores, most of which are composed of iron and oxygen.

The most useful metal. Iron, our most useful metal, can be tempered and made hard so that it will cut, or it can be made soft so that it will bend. After it runs from the furnace (Fig. 208-A) and cools, it is called *pig iron* or *cast iron*. Cast iron is strong but brittle. When most of the carbon is burned out of cast iron, we call the product *wrought iron*. Wrought iron can be heated and then hammered into any shape desired. It can be made into magnetic steel, or into non-magnetic iron. All electric motors depend on this fact and so does the compass needle.

To make steel, iron is mixed with a small amount of carbon. It has recently been discovered that steel becomes very hard or tough, or will stay hard while hot, if mixed with small quantities of nickel, chromium, tungsten, vanadium, and other rare metals. Such mixtures are called *alloys*. Alloys are very valuable indeed for making machinery and cutting tools used in the machine shop.

Unlike gold, silver, copper, tin, and bronze, iron rusts and disappears as does decaying wood. Therefore, though iron is *useful*, it is not especially *durable*. No iron objects have been handed down to us from Roman times (Fig. 209-A).

High cost for the ancients. The Greeks and the Romans had iron (and steel), but they made it very much as the Africans did. They could use only the very richest ores. Therefore, iron was very costly to them and also to the people of Europe at the time of Columbus and later.

Charcoal and coke. In Queen Elizabeth's time the English people were alarmed because the iron industry required so much charcoal. An iron furnace used all the forests near it. Laws were made controlling the iron industry in the interests of preserving the forests.

In 1735 an Englishman, named Darby, put some soft coal into a masonry furnace where it could all catch fire, but where very little air was allowed to reach it. The heating drove off all the tar, oils, and gases in the coal and left the hard substance that we call *coke*. Coke is to coal very much what charcoal is to wood. Iron can be made with a coke fire but not with a fire made of soft coal, because the solid mass of soft coal would smother the fire.

Coke brought a new era in iron making. The industry then depended not upon a forest, but upon a mine of coal from which coke could be made. With coke for fuel the United Kingdom led the world in iron manufacturing for more than a century.

Anthracite fuel. In 1836 it was discovered in America that we could make iron with anthracite, the hard coal of eastern Pennsylvania. For a time the major part of the iron industry of the United States shifted from scattered charcoal furnaces near small ore bodies in several of our Atlantic States to the hard-coal regions of eastern Pennsylvania and the near-by valleys of the Delaware, Susquehanna, and Schuylkill rivers, where it was easy to carry anthracite coal by canals and railroads.

THINGS TO DO AND QUESTIONS TO ANSWER

Why's, what's, and how's. 1. Why is limestone used in making iron?

2. Why are limestone and iron deposits usually found together?

3. What qualities does iron possess?

4. Why did the iron industry shift from place to place?

5. How did primitive peoples make iron?

6. How is coke made?

7. Why was iron so costly to the Greeks and Romans and later in England in Queen Elizabeth's time?

Enlarge upon the following sentence. The United States was very fortunate to possess not only great deposits of iron ore but also great deposits of coal.

A hunt. Try to find pictures that illustrate the making of iron.

UNIT 2—THE AMERICAN IRON AND STEEL INDUSTRY

PROBLEM. Explain how mass production in the iron industry affects your neighborhood.

Pittsburgh—a center. Soon after the iron industry became well established in eastern Pennsylvania, it was discovered that the coal of the Pittsburgh coal seam, which underlies several hundred square miles in western Pennsylvania, would make excellent coke by an easy though wasteful process known as the *beehive oven.* Three relatively large valleys join at Pittsburgh. Through the valleys trains and boats brought coke, iron ore from local mines, and limestone flux from local quarries. It is important to bring these three things together, because to make 2000 pounds of iron requires about two tons of ore, over a ton of fuel, and several hundred pounds of limestone, nearly 7000 pounds in all. The rivers also furnished the large supply of water needed in the mills. Pittsburgh quickly became our greatest iron center.

Lake Superior ores. Great quantities of iron ore richer than that of western Pennsylvania lay close to the navigable waters of Lake Superior. After 1855 boatloads of this ore came to Lake Erie ports from the ports on the shore of Lake Superior—Marquette, Duluth, Superior, and Ashland. Canals with locks had been built around the falls at the east end of Lake Superior. These were enlarged. Rocks were blasted to make channels from Lake Huron to Lake Erie, so that today steamers with ten or twelve thousand tons of iron ore follow this route every hour of the day from the first opening of navigation in spring until the lakes freeze again in the autumn (Figs. 214-A, 216-A, 218-A).

Ore traffic on the Great Lakes. This Lake ore traffic sometimes amounts to nearly seventy million tons a year. In some years it amounts to nearly as much freight as that which passes through the Suez and Panama canals combined. The returning ore vessels carry coal to the upper Lakes, sometimes for the small sum of 35 cents a ton. Otherwise nearly all of the boats would return empty to the upper Lake ports to get ore.

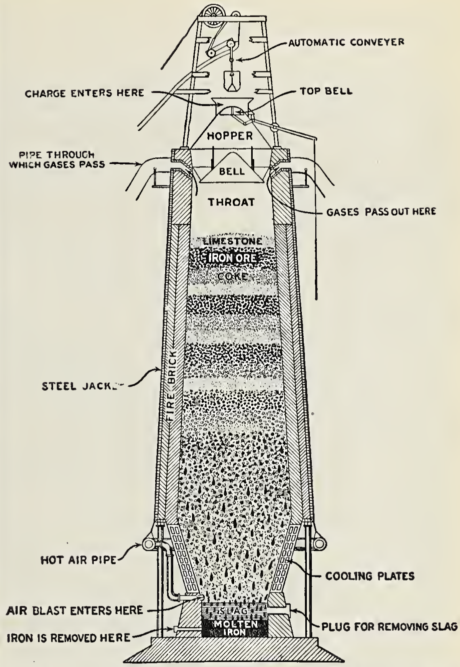


Fig. A. Section of a blast furnace. Everything that goes into it comes out as gas, molten iron, or molten slag (waste). The fire is kept burning by a blast of hot air. The automatic conveyor dumps measured quantities of materials into the hopper at the top. When the bell is lowered, they drop into the furnace, which will make 700 tons of iron a day, and burns away night and day, week day and Sunday, for months. It is a bothersome job to start one up.

Making iron in the Lake ports. Since the ore comes down the Lakes, it is as easy for the ore, coke, and limestone to be assembled at a Lake-shore port as at Pittsburgh. Therefore, great iron and steel works have been built at Buffalo, from which point supplies can be sent on by railroad and barge to Eastern markets; at Cleveland, to supply the needs of many Cleveland industries and some others; at Detroit, for the automobile works; at Chicago, for the agricultural machinery and other machinery-manufacturing plants.

Modern steel making. In the steel

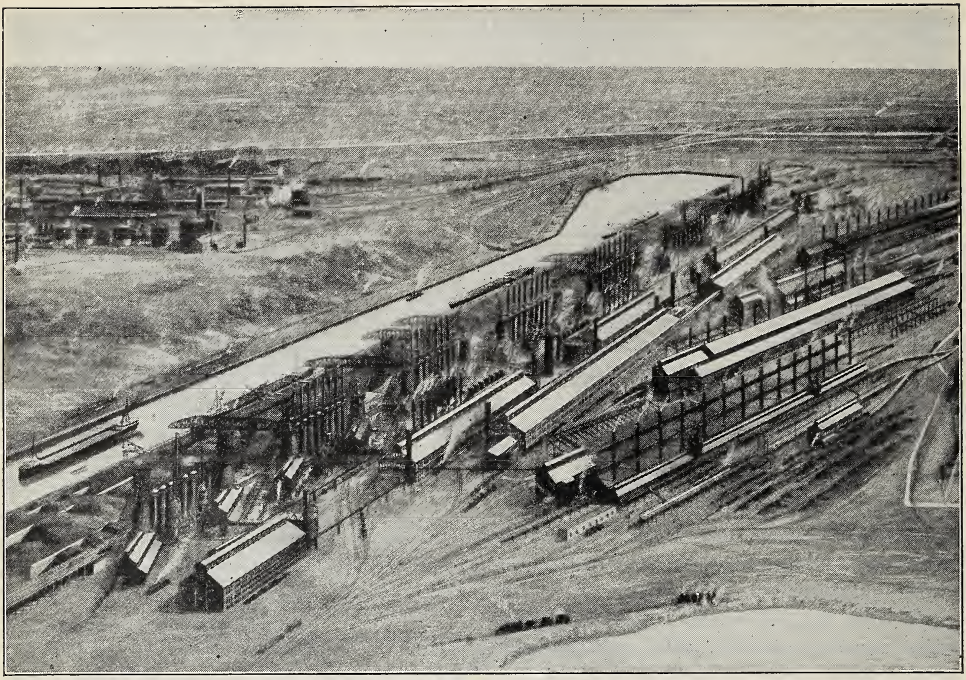
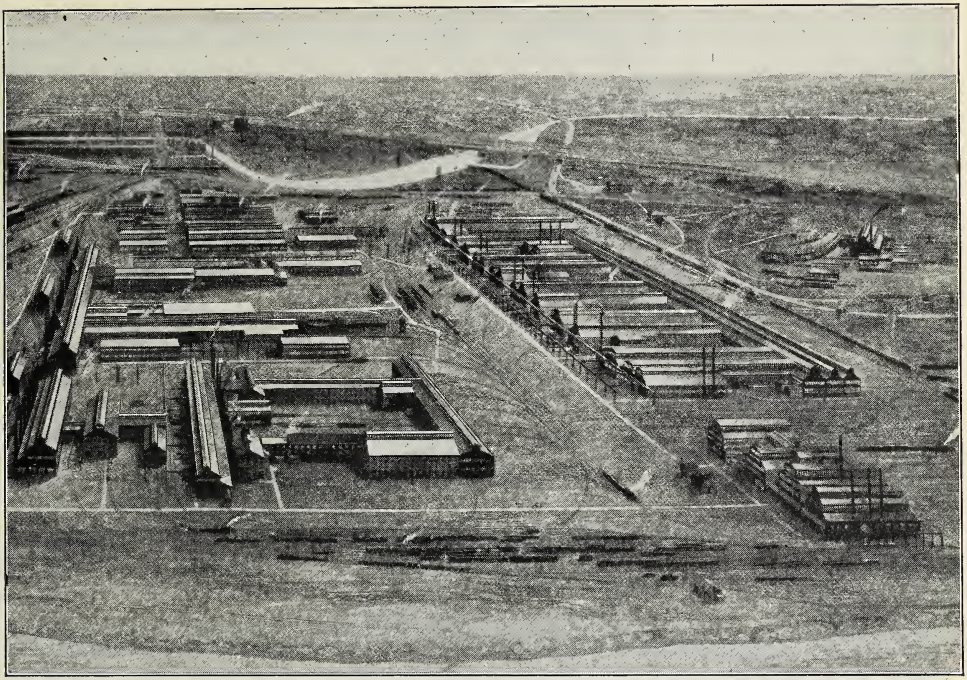


Fig. A. About *half* of the Gary steel plant, Gary, Indiana. At left is artificial harbor and Lake ore steamers, piles shapes and other forms desired in a thousand industries. There are 1350 acres of land and many miles of pig iron a day. Find railway tracks; freight cars. Can you use the cars to tell how

industry we can see mass production at work in the machine age. Steam shovels are equipped with buckets whose capacity is from 5 to 17½ tons. Ore is lifted from the hold of a steamer as easily as you pick up sand in your two hands. It is dumped on the ore pile, picked up by another steam shovel, lifted by an elevator, and dumped into the furnace. From the furnace the ore flows out as molten iron into a retort on wheels (ladle car). The car carries the molten iron to the steel furnace, where hot flames burn out the carbon. Then, by adding the exact amount of carbon needed, steel of various kinds can be made. The molten metal is next poured into a mold, where it cools to white heat. It is then carried by rail to the rolling mill, where thousands of horse power squeeze it repeatedly between heavy rolls and turn it into railroad rails, beams, plates, and billets. Billets go on while still hot to the wire mill and become rolls of wire, rolls of wire fence, or kegs of wire nails.

While all this work is being done, you see so few men in the mill that you think it must be the lunch hour—but the machines are still working. Then you see a man in a little box high above you. He is working levers that stop and start hundreds or even thousands of horse power.

By-product coke. If the gases that come out of a retort in which coal is heated to make coke are saved, each ton of soft coal makes several thousand cubic feet of fuel gas and many gallons of tar. Such coke ovens, called *by-product coke ovens,* can make coke out of many kinds of coal that will not coke in the old-style oven. Therefore, the iron industry has been enabled to move again. It may now develop in many places where coal, ore, and flux can be assembled and there is a market for the iron.



of ore, long row of blast furnaces, long buildings where molten iron is turned into steel, then steel rolled into railroad track inside the gates. When the plant is going full blast, 15,000 men work here and produce 10,500 tons of long one of the buildings is? How wide is the land shown in the front of the picture?

Other iron locations. Baltimore, Maryland, and Bethlehem, Pennsylvania, are making iron in part from ores brought by ship from Cuba. At Pueblo, Colorado, is a row of blast furnaces many hundred miles from any other blast furnaces. You can see how the freight rate gives them an advantage in a wide market.

Iron on the upper Lakes. Ore boats carrying return cargoes of coal to Duluth and other Lake Superior ports bring a good supply of raw materials. Small quantities of iron are smelted there, on both the American and Canadian sides.

Birmingham and the Great Appalachian Valley. There are many small deposits of iron ore in the Great Appalachian Valley, extending from Bethlehem, Pennsylvania, to Birmingham, Alabama. Near Birmingham there are also coal and limestone immediately alongside a large iron ore deposit—the only place in the world where the three materials are used so near to the mines that produce them.

Nova Scotia iron. A small quantity of iron is made in Nova Scotia. This location rivals Birmingham and Pittsburgh for the easy assembly of the heavy raw materials. The island of Cape Breton has a good coal field. A short boat journey brings ore from mines in Newfoundland, also beside the sea. Newfoundland and northern Ontario are rich in iron ore.

THINGS TO DO AND THINK ABOUT

Can you discover? 1. How coke was first made in Pennsylvania?

2. How iron ore was found near Lake Superior?

3. How boats go from Lake Huron to Lake Superior? from Lake Huron to Lake Erie?

4. Why Pittsburgh has new iron-center rivals?

5. Why iron can easily be made in the Lake ports?

6. Why Birmingham, Alabama, is favorably located for iron production?

7. Why Maryland and Colorado make iron?

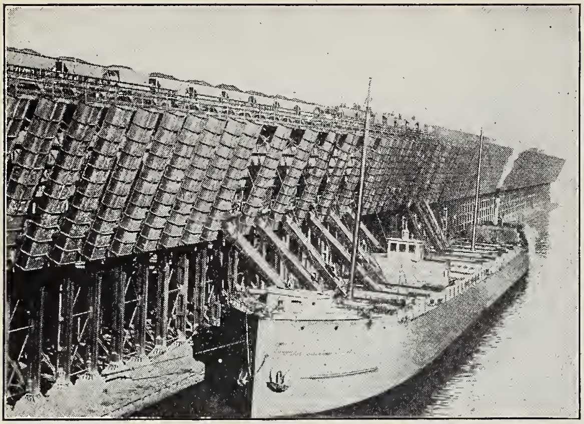


Fig. A. The ore cars at the top were loaded by steam shovel. The ore drops from the cars into bins beneath and slides down the chutes into the steamer, which can receive 10,000 tons of ore in a few minutes. The ore boat spends its season *moving*, not lying in harbors. No other ships work so many days a month.

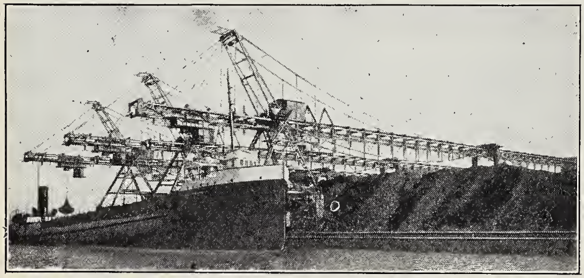


Fig. B. At left grab bucket drops down to grab ten tons of ore, lifts it up, runs away with it, and drops it on one of the ore piles at the right. Find them in Figure 214-A.

UNIT 3—THE EUROPEAN IRON INDUSTRY

SOME COMPARISONS. What does the table of iron production (page 374) tell you about the United Kingdom, Germany, and the United States at different periods? What is remarkable about the figures of production in each country?

Does the map of British coal fields (Fig. 224-A) show reasons why Britain got an early start at making iron?

Great Britain's early start and her recent rivals. There are coal fields in the middle of England (Fig. 224-A), and beside the sea on the east coast and the west coast. Blast furnaces at Newcastle-on-Tyne and other ports, both east and west, find coal almost at their very door. They can ship iron by boat to London and every other British port, and also overseas to foreign markets. Like Baltimore, these European ports also can and do unload foreign ores beside their plants.

Germany and the United States have surpassed the United Kingdom in the production of iron. There are several reasons for this. Compare the populations of the three countries (page 366). Also, the British are conservative, and they have studied science in their schools less than the Germans or the Americans have. The iron plants that made the British lead the world in 1870 and 1880 may be good still, but they are old-fashioned. Those of Germany and the United States are larger than those of the United Kingdom, and have more labor-saving machinery. Those in America are the largest of all and have the most labor-saving machinery. German scientists trained in German universities have made by-product coke and many valuable products from the by-products, much more than the English have done.

The Rhine Valley iron region. A coal field and also the most important iron region of Europe extend from the lower Rhine Valley near Köln through the little Grand Duchy of Luxembourg into Belgium and northern France. We may speak of this as a single iron region in the same way that we speak of the Pittsburgh-Buffalo-Chicago triangle as one iron region.

It is estimated that France now has half of the iron ore of all Europe. Nearly half of this is located in Lorraine, the easternmost part of France near the Rhine. Germany has about 10 per cent of the European iron ore, but much more coal than France. The coal and iron producers have arranged a trade—French ore for German coal—so

that each country has an iron industry. Belgium and Luxembourg also follow this plan. Many cities and a dense agricultural population furnish an abundant labor supply, and wages are low in the three countries.

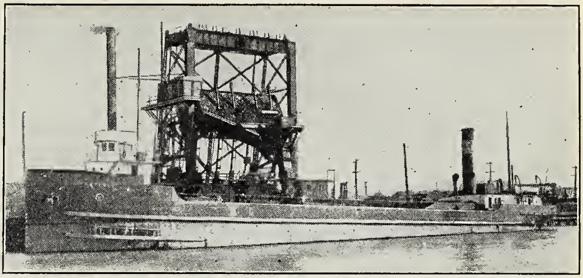


Fig. A. After the ore boat is clear of ore, she moves around to the coal dock, where this machine picks up cars of coal, one after the other, and dumps them into the vast body of the ship.

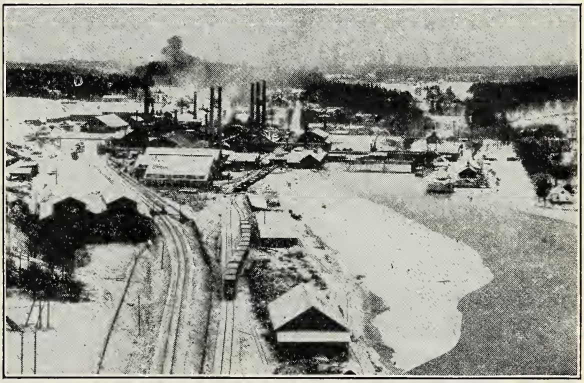


Fig. B. One of Sweden's best-known iron and steel works, near Stockholm. This great plant has blast furnaces, a crucible-steel mill, electric-smelting works, a rolling mill, and hardware works. At what season was the picture taken?

Smaller iron centers of Europe. There is a coal and iron district in central Germany in the old state of Saxony near Dresden; another over the Silesian coal field in southeastern Germany and southwestern Poland; and another in Bohemia (western Czechoslovakia). The Russians have recently been working very hard to develop a large iron center in the Donets coal field near the lower Don.

The Swedish iron industry and Europe's ore trade. Sweden, with so much of her land in forest, still uses charcoal for fuel in making iron. The finest iron in the world is made in Sweden. It is used in many countries by the makers of knives, surgical instruments, parts for watches, and for other very fine work in iron and steel.

Sweden is also a great iron-ore exporter from fields in the northern part of the country beyond the Arctic Circle. In winter a railroad carries the ore over the mountains to the Atlantic port of Narvik. In summer the boats sail down the Gulf of Bothnia with ore for the British iron furnaces, the Rhine Valley furnaces, and those of Germany and Poland on the Silesian coal fields.

Spain, with her ore fields near the port of Bilbao, is the third great ore exporter of Europe, France being first. Neither Spain nor Sweden is supplied with coal to run a large-scale iron industry.

THINGS TO DO AND QUESTIONS TO ANSWER

Some things to explain. 1. Why Germany and the United States have surpassed England as producers of iron and steel.

2. Why Sweden still makes charcoal iron.

3. How Sweden exports her iron ore.

4. Resemblances between an American iron region and a European iron region.

5. Why a state in the United States made as much iron in one year as did the United Kingdom.

A European iron map. On an outline map of Europe show the following:

1. England's iron deposits.

2. The most important iron regions of Europe.

3. The routes of Swedish and Spanish iron ore to England.

Europe's iron supply. These five squares represent the total iron supply of Europe. How many squares would you shade for the amount possessed by France? Where is France's iron located? Does this help to explain troubles between France and Germany?

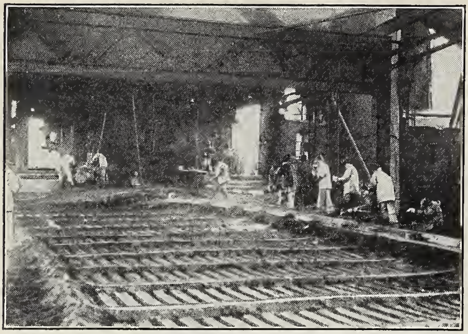


Fig. A. Casting pig iron at the Anshan Iron Works, Japan.

UNIT 4—IRON IN OTHER COUNTRIES

> A Question of National Policy. Should every country make its own iron?

Countries that buy iron. There is not a single modern, large-scale iron and steel works in all Mexico, Central America, West Indies, South America, Africa, Australia, the East Indian islands, or the major parts of Asia. There are many *ore deposits* in these countries. There are fairly good coal fields in the Union of South Africa, and one in New South Wales near Sydney. But more than coal is required for making iron. Hundreds or even thousands of workmen, millions of dollars of capital for great plants, good government, and above all, a great market are necessary to keep a big iron and steel plant running.

Iron in India. India is an importer of iron, although she has some of the finest ore in the world, containing 64 to 67 per cent iron. One Indian iron company employs 25,000 native workmen, and 125 Europeans and Americans as experts, managers, and superintendents. This iron industry is in the edge of the plateau southwest of Calcutta.

Japan. Japan has a small iron industry, but the country is very poor in materials. She has but little coal, and even now imports from China and Manchuria most of the ore she uses. Japanese companies have built iron plants along the South Manchurian railway in South Manchuria, where there is much more coal than in Japan.

China. The Chinese have one fairly modern iron works at Hanyang, across the Yangtze from Hankow. This plant at times sent iron to San Francisco, but it suspended operations a few years ago because the civil wars that have disturbed China so much since 1925 interfere greatly with such a business.

Iron-ore reserves. We are now using the best or most easily gotten ores known to man, but there are in Brazil and elsewhere large deposits of both high- and low-grade ores that will supply us with iron for several centuries. English iron makers have bought large reserves in Brazil.

THINGS TO DO AND QUESTIONS TO ANSWER

Beheaded sentences.

1. ——— has a modern iron works at Hanyang.
2. ——— has some of the finest iron ore in the world.
3. ——— has large deposits of low-grade iron ores.
4. ——— will last us for several centuries.

Think on paper. Make a list of at least six reasons why the countries discussed in this unit have produced little or no iron.

CHAPTER SUMMARY

New words and expressions. Beehive oven, alloys, tonnage, by-products, coke ovens, tempered, magnetic, and nonmagnetic. Use each in a sentence.

Brief talks. After reading this chapter and looking at the pictures carefully, make brief talks about iron under these subjects: "mass production," "machine made," "large scale," "small scale," reserves for the future, "Julius Caesar's iron," "Queen Elizabeth's iron."

A transportation map. 1. Make a map showing the main steamship routes from the iron-ore deposits near Lake Superior to the great smelting plants near Lake Erie.

2. How does this map help you to explain why such cities as Detroit, Cleveland, Gary, Chicago, and Pittsburgh have developed so rapidly? (Keep your map.)

An iron-regions map. On an outline map of the world show the principal iron-ore deposits mentioned in this chapter.

Start a class museum. Show things that illustrate the iron industry or are related to it.

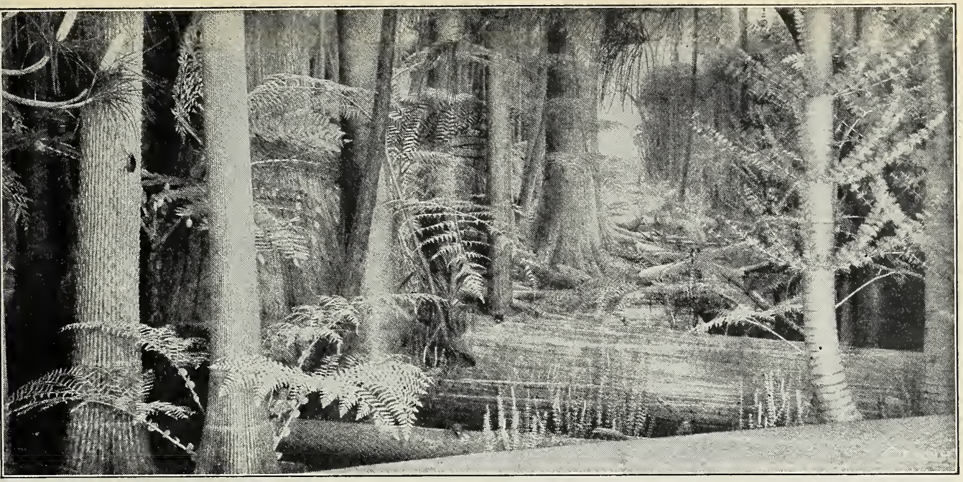


Fig. A. The coal which we are now using was made from plants like those in this picture. The plants fell down into the water and were covered with mud. The mud hardened into stone. The plants changed into coal.

CHAPTER XXIII

COAL AND OTHER FUELS

UNIT 1—IMPORTANCE AND KINDS OF FUEL

Fig. B. This piece of shale rock was found in a coal mine. It has on it the print (fossil) of a fern leaf.

A PROBLEM IN REORGANIZATION. What changes would come to America if we should suddenly go back to using *crop fuels*?

What is fuel? In a burning match you see chemical action taking place. The carbon of the wood unites with the oxygen of the air and becomes carbon dioxide gas. The union of carbon and oxygen is chemical action and produces heat, which makes the flame. Man discovered this fact long ago and learned to make use of it for his own comfort. Since that time man has everywhere gathered fuel to make fire.

Early fuels. For ages man has used crop fuel—such as wood, twigs, leaves, cornstalks, bean stalks, straw, grass, the remains of plants he had gathered, and animal dung in lands where other fuel is scarce. You doubtless know that most Chinese farmers have only fuel enough to cook their food. The lack of fuel is a great hardship in a cold country where the ground is frozen for months.

Crop fuel is too scanty to be of much use in running the engines that we use today.

Fossil fuel. All coal, including peat, is sometimes called *fossil fuel.* Coal is the remains of plants that lived long ago and, luckily for us, have been preserved in a form useful for fuel. We may say that the machine age began when Watt's steam engine first pumped water and lifted fossil fuel (coal) from an English mine.

The coal age. Between 1790 and 1930 the population of the United States increased about thirty-one fold and the population of Europe about trebled. These increases occurred chiefly because coal became available. When pigs and wheat could be sent long distances to market, farms spread quickly across the continent and cities began to grow. Coal, mostly bituminous coal, fired the boilers that made

Fig. A. This flashlight photograph shows on the miner's cap the little lamp which makes enough light for him to see his work. Of what material is the roof? Suppose a bit of it falls? Find the layer of slate (once mud) in the midst of the shining coal (once a mass of peat in a bog). Coal-mine cars have been pulled by men, women, donkeys, and mules, and now often by electricity. How thick is this coal layer? What difference would it make if the coal layer were only two feet thick?

steam for the railroad which opened up the new lands. It also made steam for the engine that ran the factory, for the locomotive that drew the train, and for the steamship that carried food and raw materials. Coal made city gas and most of the electric light and electric power. Coal heated most of the city homes and public buildings and cooked the food of most of the people.

Where coal forms. Coal in its early stages of formation is peat, and peat is formed in swamps in cool countries. The wood and leaves decompose partly into a brown jellylike mass which is preserved by the water of the marsh or bog and by acids in the vegetable material. Peat bogs are to be found in Ireland, Holland, Germany, Poland, Russia, Canada, and New England. Peat does not form in Cuba or India, nor in any other hot country, because, when vegetable material falls in *hot* climates, it rots and disappears. Therefore the tropic world has almost no coal. Very little coal exists in lands with a Mediterranean type of climate. Most of the world's coal lies in a cool belt between 35° and 60° of latitude.

The importance of fuel. I have seen little boys and girls raking up very small quantities of leaves and grass beside the road in China. It was the only way they had to get something to cook the food. In treeless parts of Russia people cook with straw fires. Read in the Roosevelt book, *East of the Sun and West of the Moon* (see book list in the Appendix), about Asiatic winter in a fireless tent.

Already we have worked out many coal mines, and the miners have had to move to other places.

THINGS TO DO AND QUESTIONS TO ANSWER

Do you know? 1. What chemical action takes place when an object burns?

2. The meaning of "fuel," "crop fuels," "fossil fuels," "peat bogs," "coal age"?

3. Why there is little coal in the tropics?

4. The uses of fuel in your neighborhood?

Map work. On a map of the world locate where coal is found.

National policy. Is coal mining a "robber industry"? Should people be allowed to mine coal wastefully? to burn it in wasteful heaters? to use it where water power might be used?

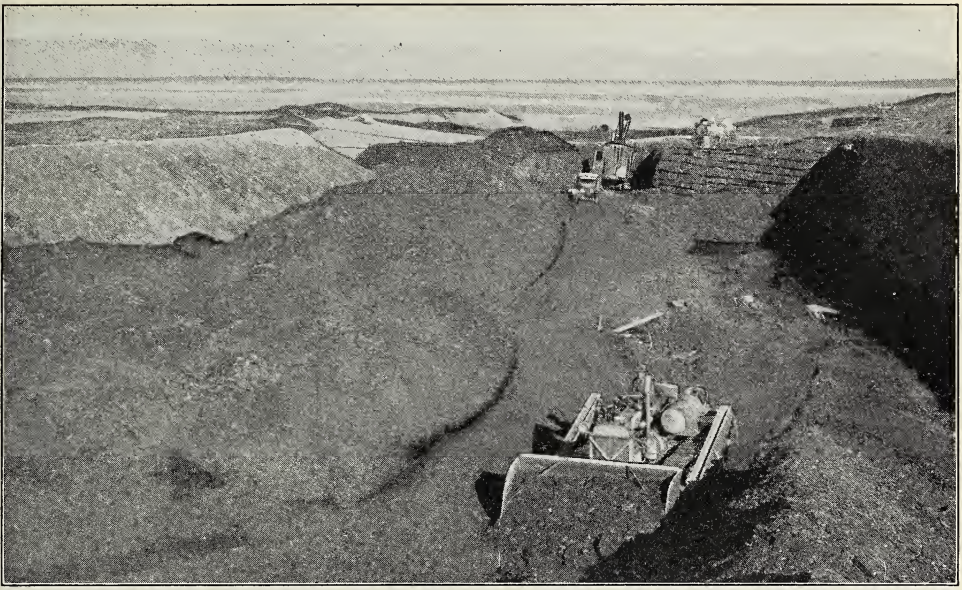


Fig. A. This open-pit coal mine in Colorado shows the simplest of all methods of coal mining, often called *stripping*. First the dirt is shoveled off, then the coal. In the far end of the pit, near the steam shovel, the layers of coal may be seen. What is the machine in the foreground doing? I saw a hole like this in the German plain north of Berlin, and it appeared to be big enough to swallow a city. There is a very large one in Manchuria.

UNIT 2—COAL IN THE UNITED STATES AND CANADA

A QUESTION OF LOCATION. What would be the effect on the American people if all our coal were found in one state?

Kinds of coal. Peat, the first stage of coal, when taken out of a swamp is a soft brown mass of partly decayed leaves mixed with bits of partly decayed tree bark. When peat is dried, it is much used for household fuel in Ireland, Holland, and the Baltic countries.

Peat has been changed into several kinds of coal by pressure of earth upon it for a great length of time:

1. Brown coal, or lignite (peat somewhat compressed), exists in great quantities in the American Great Plains region and in northern Europe.

2–3. Semi-bituminous and bituminous coal are black and give out more heat than brown coal gives. The Germans found that for heating purposes 4½ tons of lignite are equal to 1 ton of bituminous coal. In Germany large quantities of lignite and soft bituminous coal are pressed into lumps called *briquettes* (little bricks). The coal is held together with a little tar or sticky clay.

4. Anthracite. If a layer of bituminous coal and the rocks between which it lies are pressed and bent when mountains are being made (Fig. 210-A), the pressure causes the soft or bituminous coal to lose its gases and tar (pages 214 and 275). It then becomes hard coal, or anthracite.

Early American coal mining. Coal is heavy, so we cannot afford to haul it for any great distance in a wagon. A hundred twenty years ago, before we had railroads, the only coal field of commercial importance in the United States was a small anthracite field near Richmond, Virginia. Only a short haul by wagon was necessary to carry the coal to the James River. Then canal boats took it to Norfolk, Washington, Baltimore, and Philadelphia.

Fig. A. Map of the United States showing where coal is found.

Pennsylvania anthracite. The early American canal builders, knowing of the anthracite coal fields near Scranton, Wilkes-Barre, and Shamokin in Pennsylvania, built canals to carry the precious coal to New York, Philadelphia, and Baltimore. Soon after the canals were completed, the first railroads were built. Half a dozen lines now carry anthracite coal to a hundred cities, and to boats in the harbors at Philadelphia, New York, and Buffalo. Anthracite is splendid coal for every purpose, and its location near the great cities of the East facilitates its use. But, alas, half of the supply is already used. The anthracite deposit comprises only about 480 square miles, all in eastern Pennsylvania.

The rich Appalachian field. The Appalachian Plateau from northern Pennsylvania to northern Alabama consists of layers of rock that lie almost flat, like the pages of a book. Between the layers of rock are many layers of rich bituminous coal. In hundreds of places where streams have cut little valleys in the plateau the streams have cut through the coal. There mining it is very easy; one just digs into the hillside and hauls out the coal (Fig. 210-A).

During the World War, when there was a great demand for coal, many new mines were opened in all parts of this field—in Pennsylvania, West Virginia, Virginia, Kentucky, Tennessee, and Alabama. The demand for coal soon declined. This was followed by keen competition among mines for markets, and among miners for jobs. Unemployment in the mining districts became widespread. The unemployed miner became one of the great problems of the depression which began in 1929.

Central location. The rich coal supply of the Appalachian field is close to the Atlantic ports and close also to the Ohio and its navigable branches, the Allegheny, the Monongahela, the Kanawha, the Cumberland, and the Tennessee. Coal can be put upon barges and sent downstream to Cincinnati, St. Louis, and New Orleans, and to many other river cities. The Lake cities are only a short distance from the coal fields, so these cities have cheap coal as well as cheap iron.

The parts of Canada between Lake Huron and Montreal are much nearer to the coal mines of Pennsylvania and Ohio than they are to the Canadian coal. Therefore, we send millions of tons of Appalachian coal across the border.

Great length of coal formations. The Appalachian formations of rocks and coal appear again in the coal fields of Nova Scotia (page 215), and underlie some of the flat lands of Indiana and Illinois. Similar coal seams are found in Kansas and Iowa.

The Rocky Mountains and the Pacific coast. There are many small coal fields in the Rocky Mountains. Some of these are anthracite, and the coal from them is used locally. Unfortunately, the Pacific coast, a part of which has the Mediterranean climate, has very little coal. California, however, is lucky enough to have a rich oil field instead.

Lignite, the great reserve. What does Table 28 tell you about the amount of

Fig. A. In England these coal-mine cars might be half a mile or even three quarters of a mile below ground. In many parts of the Appalachian and other coal fields they run straight out of the hillside. Does the roof here differ from that in Figure 220-A? Shiploads of trees are used for mine props each year.

lignite in our Western States? That is a reserve of fuel for future use. For mile after mile, county after county, great layers of brown coal—ten, fifteen, or thirty feet thick—lie there awaiting the time when the people of the United States must use lignite because the better coal has been used. Is the lignite well located for meeting the needs of our densely peopled sections?

Canada has billions of tons of the same lignite formations that underlie our Great Plains, but unfortunately Canada has no coal supply between Winnipeg and Quebec. For this reason she imports large amounts of American coal.

THINGS TO DO AND QUESTIONS TO ANSWER

Using your dictionary. Make sentences using the following words: peat, lignite, bituminous coal, anthracite coal, transportation.

A map. Draw a large map of the eastern half of the United States. By reference to the table on production of coal by leading producing states, place as many dots in the state as that state produced millions of short tons of coal in 1930. Show the coal reserves by different colored dots or by vertical graphs standing in the state.

Something to make. A graph comparing the leading coal-producing states (page 360).

UNIT 3—EUROPEAN COAL

Europe's Future. By using coal Europe has about trebled her population. Can coal continue to maintain this population?

British coal. A hundred twenty years ago, while we Americans were busily at work building canals upstream toward the anthracite region, London had for centuries been feeding her thousands of open-grate fires with coal brought by sea from Newcastle on the navigable Tyne to London on the navigable Thames. Britain was lucky in that she mined coal immediately beside her harbors. Ocean ships could, therefore, load coal easily—English coal at Newcastle-on-Tyne, Welsh coal at Cardiff and Swansea, Scotch coal at Glasgow. Compare Britain's coal exports with those of other countries (page 360). For the last half century Britain has lived upon her coal in more ways than one. Much coal goes out as return cargo in boats that bring food and raw materials to her.

Unfortunately, British coal mines are deep, the seams (Fig. 210-A) are mostly thin, and much more work is necessary to get out coal than is required in Appalachia.

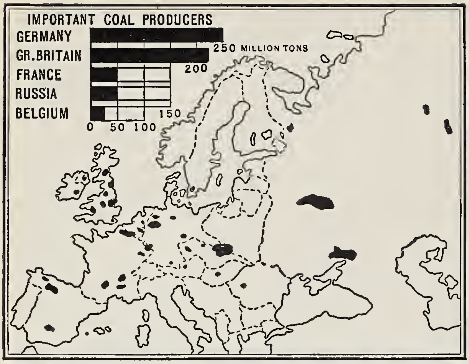


Fig. A. The solid black areas on this map show the important coal fields in Europe.

Fig. B. This mechanical shovel will lift one and one quarter cubic yards of earth, ore, or stone at one bite.

Coal on the continent of Europe. A region somewhat similar to our Appalachian coal region exists in Europe. It includes Belgium, northern France, Luxembourg, and the lower Rhine. This is a land of coal mines, iron works, factory towns, and densely peopled countryside. As barges carry coal on the Ohio and its branches, so barges carry coal on the Rhine and its branches. The two German valleys, Ruhr and Saar, are especially famed for their coal and iron industries.

Stripping lignite. Improvements in the mechanical shovel have been made until now the electric shovel scoops up at a bite 20 to 40 tons of sand, clay, gravel, or coal. The mechanical shovel has caused a great increase of mining by stripping (Fig. 221-A), both in the United States and in Germany —especially in Germany, where much lignite is mined in this way. The lignite is not taken away, but is used to feed superpower plants beside the mine. Thus it is converted into power, and the power is carried by wire to Köln, Leipzig, and many other cities.

Other coal fields. As the United States has scattered coal fields in the interior (Fig. 222-A), so has Europe: the Silesian (Polish-German), Bohemian (Czechoslovakian), the Donets (South Russian), and the Austrian. Each supplies a home industry and sells some coal to neighbors.

Unfortunately, there is no coal of any importance in any part of the land that has a type of Mediterranean climate. What does the table of coal imports tell you about those countries? Compare chances to develop industry there with the chances of Ohio or any other American state of your choosing.

THINGS TO DO AND THINK ABOUT

For thought and careful reading. 1. Explain why England was ready for the engine; for export.

2. How do the mines of England compare with those of the Appalachian region?

Fill in the blanks.

In Germany, huge ——— ——— lift great masses of ——— at a time. This lignite is fed to large ——— ——— which are located near the mine. Thus the ——— is transformed into ——— ———, which is then sent by means of wires to the manufacturing centers, such as ———, ———, and ———. Thus Germany brings her power to her factories in place of bringing her factories to the source of power.

A coal-import map. Have the best artist in your class draw a map of the world on the blackboard or bulletin board. See Table 29, page 360. Draw arrows from the coal exporters to the coal importers. Draw one line for each two million tons. Find a coal map of the world. Make your large map to show the main coal areas shown on the coal map.

UNIT 4—COAL IN ASIA AND THE SOUTHERN HEMISPHERE

China and Argentina. Do you think it possible that China may some day become a nation with factories similar to those of Europe and the United States? What about Argentina? State your reasons.

Resources or mines? Compare the coal *resources* in Europe and Asia (page 360) with coal *production* in the two continents. You see that it takes more than coal to make a profitable mine.

China, with her great resources of coal, is still largely in the domestic stage of industry (page 204). I have seen coal mines in the great anthracite field of the province of Shansi with entrances only large enough to admit a man carrying a basket and where coal was carried away in wheelbarrows and mule carts. China has few railroads. Even where there are railroads, many people have nothing to sell and, therefore, have no money with which to buy coal.

Japan, whose coal resources are few, is using them quite fully. How long would her coal resources last the United States? (Page 360.)

The Japanese have control of many Chinese coal and iron deposits. Near Mukden, in Manchuria, thick seams of coal have been so bent, twisted, and folded that a tract of 25 square miles has on it coal from 78 to 420 feet deep—a total of a thousand million tons. The Japanese are mining the coal by the strip or open-pit method. They are building a corkscrew railroad round and round the sides of a great hole which they think will be a thousand feet deep by the time the deposit is exhausted.

The Southern Hemisphere. The Southern Hemisphere is not quite so poor in coal as are the tropics, but its lands do not reach quite far enough toward the Pole to be in the latitude where nature made great coal deposits. Chile has some small deposits (about latitude 40° S.). But already the mines extend under the sea as do those of Wales. South Africa has a little coal in Natal and also in the Transvaal. Australia has a fair-sized coal field near Sydney. There is some coal in New Zealand. But compare the resources of the Southern Hemisphere countries with some of the American states (page 359).

Argentina, a land with abundant agricultural resources and a great food supply—with, therefore, the possibility of feeding many people—has not a coal mine worth mentioning. The railroads that carry her farm produce to the sea are owned by British companies with offices in London; the engines and cars are built in British factories; and the locomotives are fed with some two or three million tons of British coal each year.

On a recent date, when Welsh coal was selling for $4.43 a ton on shipboard in Cardiff, it cost $10.32 in Buenos Aires and $10.80 in Rio de Janeiro. The price was higher in Rio de Janeiro because that city, unlike Buenos Aires, did not have grain to send as return cargo. At 6000 tons each, how many coal ships unload in Argentina each year (page 360)?

THINGS TO DO AND QUESTIONS TO ANSWER

Playing prospector. European capitalists sent agents abroad to check on the possibility of engaging in coal mining. The agents report:

1. I visited China and found ———.
2. I visited Japan and Manchuria and found ———.
3. I visited South America and found ———.
4. I visited Africa, Australia, and Oceania and found ———.

A thought question. Is there a fuel reason why Japan is interested in Manchuria?

Some thought problems. 1. Which coal fields have had the best chance to use water transportation?

2. Describe how things were brought from Kansas to Chicago *before* coal was used.

3. Why have the Western coal fields been so little used (Fig. 20-A)?

4. What does a coal map of North America show you regarding coal production and coal supply in the eastern parts of Canada?

5. Compare tonnage for railway freight of a wheat crop of 700 million bushels, at 60 pounds per bushel, and of 350 million tons of coal.

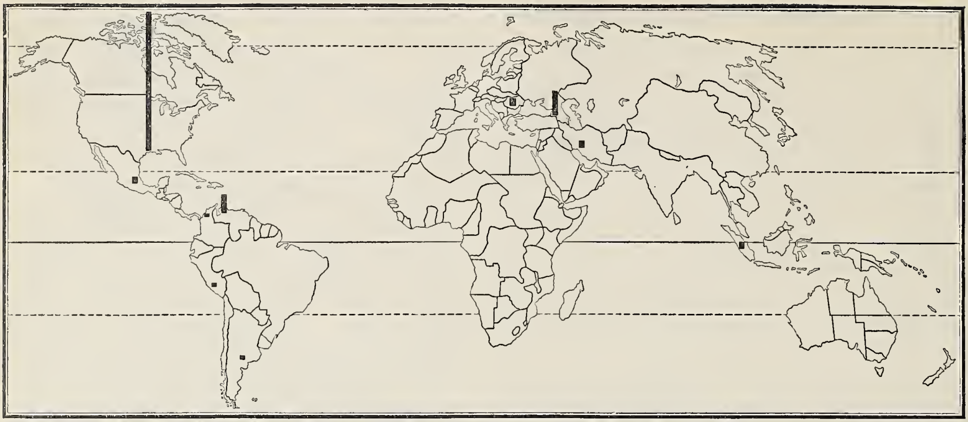


Fig. A. The world's oil resources. Name the five leading countries as shown by the five tallest bars. What does the map tell about the United States? See Appendix table, page 360.

UNIT 5—PETROLEUM

A Far-reaching Problem. Make a list of the uses of petroleum in its various forms, including gasoline. Have some older person tell you how many of these uses have been discovered since he or she can remember. What changes would result if all petroleum disappeared suddenly?

A double team. The list of uses shows you that the machine age depends upon a double team: coal and oil. Indeed, coal, petroleum, and electricity enable man to do many of the things he once dreamed about doing but thought impossible. Before petroleum was found, most American homes were lighted with candles made of tallow or by lamps burning whale oil or other animal oils.

Origin of petroleum. All the wonders of petroleum arise from mud on the bottom of the sea. Slowly, year after year, generation after generation, century after century, millennium after millennium, ages ago, little animals and plants died and their bodies fell to the bottom of the sea. The sea became covered with a layer of mud which contained the animal remains. Our present petroleum came from the remains of their bodies buried long ago on the sea bottom. The mud became covered with other layers of earth material and hardened into rock called *shale*. Then the sea bottom was raised until many of the oil rocks are now covered by dry land, sometimes even by mountains. All this took a great length of time.

In some places the oil shale has the oil material (hydrocarbons) scattered through it. In other places something has happened to cause the oil material to collect in pools. If the shale layer happens to have a slight bend in the shape of a dome (Fig. 229-A), and also to be covered by a layer of waterproof rock, the oil collects in the top of the dome in a pool. Then if man drills a hole through the dome the oil runs out.

Oil springs. Many a layer of oil-bearing rock has cracks in the rocks above it through which oil and gas have come to the surface. Sometimes the gas has burned, and for many centuries there have been fire worshipers in the Caucasus Mountains who worshiped this mysterious, constant fire. In other places the oil ran out, dried, and left asphalt on the ground. By this sign prospectors know where to look for oil. The farmers of western Pennsylvania, a hundred years ago, put boards across the oil springs to separate the oil and the water so that their cattle could drink.

Oil wells. After we had learned how to drill the deep wells known as *artesian* wells, a man named Drake, in Pennsylvania,

drilled an oil well in 1859, and pumped out the oil. This was really the beginning of the petroleum industry. Before this time, men placed blankets on oily springs and, when the blankets were full of petroleum, they squeezed the oil out and sold it under the name of *coal oil.*

Fig. A. Long Beach oil field, Los Angeles County, California. This field is also a producer of natural gas.

Oil fields. Drake's well set many neighbors drilling. Thus the first great oil boom began. From that day to the present we have continued to find new oil fields and new uses for oil (Fig. 231-A).

Many wells were dug in the Pennsylvania field and in a few years the yield began to decline. Fortunately, other fields were discovered.

The first oil fields were found in the Ohio Valley, within relatively easy access of New York, Washington, and many cities of the interior. Other fields were found in the Ohio and upper Mississippi Valley; then in Louisiana, Texas, Oklahoma, and California. Oil is so well distributed over the United States that it meets the needs of the entire country.

Pipe lines. When an oil field is first discovered, railroads take trains of tank cars to carry the oil. This kind of transportation is too slow and costly for a great oil field. Therefore, pipe lines are laid underground (Fig. 231-A). Oil is now pumped through pipes from Texas, Louisiana, and Oklahoma to Chicago, and, if need be, from Chicago to Baltimore and New York as well as to Gulf ports.

At the present time the most important oil fields have pipe lines to the sea. There are oil fields in the Mackenzie Valley region of Canada, far to the north of any railroad, but as yet there is no way of getting the oil to market. The wells remained capped for many years, but were opened in 1932 to supply oil for the mining operations of the Great Bear Lake field.

Tankers. Special ships called *tankers* have been built to carry oil. These ships have compartments like tanks. Oil is pumped into the tanker through a pipe line which reaches the oil field—we shall say in Texas, California, Venezuela—and pumped out again at the refineries of Philadelphia, New York, London, Hamburg, Napoli, Sydney, or Buenos Aires.

Oil refineries and oil products. As oil comes out of the ground, it is a dark, thick liquid. In the refinery it is put into a tank or into coils of pipe and heated. This "splits" the oil. A certain amount of heat causes the lightest oils, like naphtha and gasoline, to turn to vapor, pass away through a pipe, and condense into liquids. As the heat is increased, kerosene and other heavier oils vaporize, and pass to other containers and condense. Thus one product after another separates as the oil splits up into many commercial substances. Finally, there is left in the retort a mass of black asphalt if the oil has an *asphalt base*, or a mass of paraffin if the oil has a *paraffin base.*

Average crude petroleum produces 25 per cent gasoline, 10 per cent kerosene, 33 per cent fuel oil, 7 per cent lubricating oil, and 25 per cent heavy residue which may also be burned under boilers if desired. The use of oil for heating houses and for firing the boilers of locomotives and ships has reduced the demand for coal.

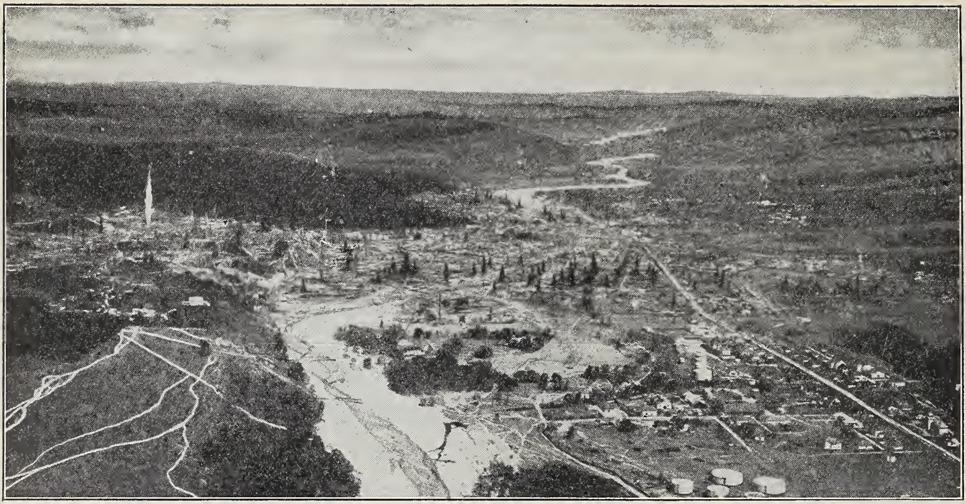


Fig. A. An oil field in Rumania. The well at the left had been burning for two months at the time this picture was taken. Do you think this field has the right number of oil wells (Fig. 229-B)?

Foreign oil fields. The United States is first in the production of petroleum and has held this position, although there are many foreign oil fields. The United States has become an oil importer. The first great foreign oil field was the Russian, at the eastern end of the Caucasus Mountains near the shore of the Black Sea, with Baku as its center. This field has maintained its production better than any other in the world, and has long had pipe-line connections with Batum.

Mexico surpassed Russia with a rich field in the plains around Tampico, but it soon declined. Venezuela took the lead, only to lose it in a short time to U. S. S. R., which increased its output in 1931. The Venezuelan oil field is on the plain around Lake Maracaibo. Small ships carry oil out of this shallow lake to the near-by Dutch island of Curaçao. Here tankers are loaded for many foreign countries and here there is one of the greatest oil refineries in the world, having a capacity of 165,000 barrels daily.

It is thought that great oil fields may be discovered at other places along the eastern base of the Andes Mountain system.

Many small fields. There is a small oil field on the west point of Peru which is capable of supplying most of the needs of the west coast of South America. Rumania has a small field. It exported 28 million barrels of petroleum products in 1930, but it does not have a pipe line because the oil goes in all directions to near-by places.

The most important field in Asia is near the head of the Persian Gulf, partly in Persia and partly in Iraq. It is managed by a British oil company known as the Anglo-Persian Company. There is an oil field farther up the river near Mosul, from which a pipe line carries oil to the Mediterranean. There are also oil fields of moderate production in Burma, Sumatra, and other parts of the East Indies, but altogether the Eastern Hemisphere does not produce as much petroleum as it uses.

The wells in nearly all these foreign fields have been dug by American oil-well drillers using machinery built or invented in the United States.

The oil trade. Few commodities have a more widespread trade than petroleum and its products. "What is the most characteristic thing I can take home with me from the West Indies?" I asked an American when visiting there. "A Stand-

ard Oil Company five-gallon kerosene can," he replied. "It is the most universal thing in the West Indies."

The can of kerosene, supplying light for family lamps, travels by boat, mule back, man back, and wheelbarrow to every corner of China, and has been bought and used by thousands who have never even seen a white man.

Wherever there is an automobile, a bicycle, a phonograph, a sewing machine, or a typewriter, you may be sure there is an oil can squirting petroleum lubricant into its working parts. Ships loaded with oil and oil-refinery products sail to many foreign lands from Los Angeles, Galveston, Philadelphia, Bayonne, New Jersey (New York harbor), and other American ports. There are very large refineries at Marcus Hook, a suburb of Philadelphia; Whiting, Indiana, a suburb of Chicago; and Richmond, a suburb of San Francisco.

Coal and oil at sea. About a third of the newer ocean steamers now burn oil. It is so much less work to pump oil than to shovel and carry coal, and oil gives about one quarter more heat than coal of the same weight. Just as an automobile stops at a filling station beside the road, so an ocean steamer stops at coaling and oil stations on the great sea routes—you can pick them out yourself on the route from England to Japan.

Oil shale for the future. Our oil fields will not last many generations. Then we shall blast oil shale, crush it, and distil the oil. This is already being done a little in Scotland, Estonia, and Spain. A ton of Scotch shale yields 24.5 gallons of crude oil, 36 pounds of ammonium sulphate (a nitrogenous fertilizer), and fuel gas with a heating value equal to that of 3500 cubic feet of common city gas. Some day oil-shale refineries may produce great industries in the Rocky Mountains, where there are vast deposits of shale. But oil and coal and oil shale will probably all be gone within a thousand years, which is as but a day in the long history of the human race.

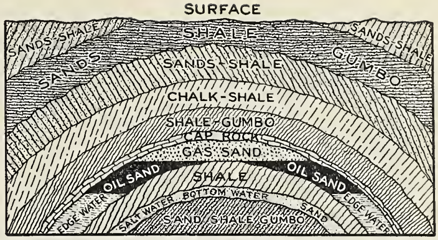


Fig. A. How oil and gas occur in the earth. Tell how you would get this oil and gas.

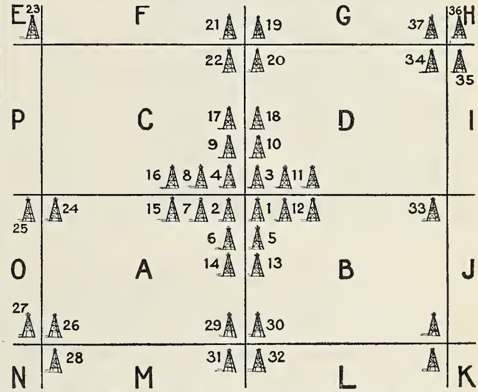


Fig. B. Oil waste. A, B, C, etc., are farms and farm owners. Oil is discovered by well No. 1. It will draw oil from several farms; so A rushes well No. 2; D, well No. 3. Can you explain why the wells are drilled in this order of their numbers? Each costs many thousand dollars, and five wells or possibly even one well would have got more oil in time than all of the many wells get. Why? Do you approve of this waste? The oil industry needs a plan.

THINGS TO DO AND QUESTIONS TO ANSWER

I am petroleum. 1. I was formed by ———.

2. I am found throughout the world in large oil fields, some of which are ———.

3. I am transported by the following means: ———.

4. I am refined by ———.

For extra credit. Write to the United States Department of the Interior and ask for their list of publications regarding petroleum, its formation, its production, and its uses.

Do you know? 1. How oil is often secured where it cannot be had by drilling?

2. What is meant by refining?

3. Why pipe lines are used?

4. Why it is necessary to conserve our petroleum supply?

5. Why kerosene is demanded throughout the world?

6. Who drills most of the oil wells?

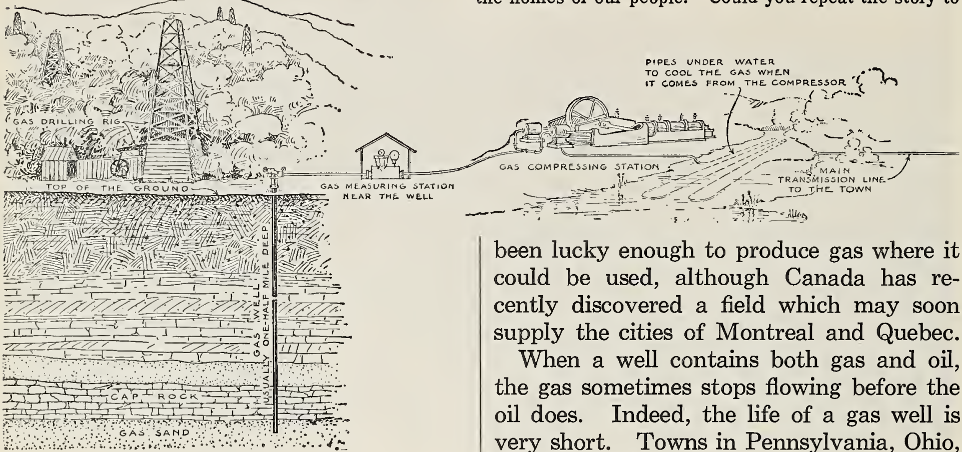


Fig. A. Natural gas is the best and most convenient of all natural some cities it sells for less than one third the price of manufactured picture tells clearly the story of natural gas from the time it leaves the homes of our people. Could you repeat the story to

UNIT 6—NATURAL GAS

> A Vital Public Question. What would you do if you could make laws about natural gas and have them enforced?

Fuel partners. Some of the carbon in the oil shale collects in the pool in the liquid form of petroleum, and some in the form of natural gas. Both products come out of the same well. The gas under the pressure beneath the rocks spouts out as does the carbon-dioxide gas in a bottle of soda water. Sometimes the pressure of gas and oil is so great that when the oil is reached, it shoots the drill, weighing hundreds of pounds, right out the top of the well, and the gas blows the oil hundreds of feet into the air. This is called a *gusher*.

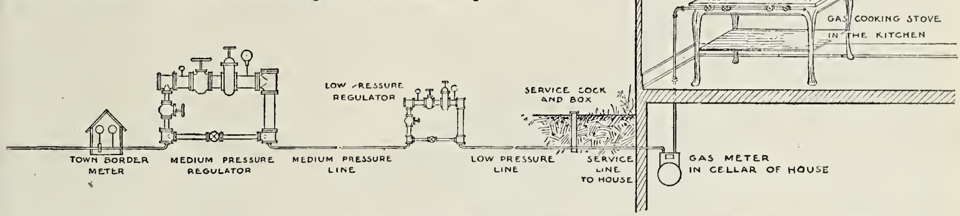
The perfect fuel. Natural gas is the most perfect fuel in the world. It yields more heat than the city gas for which people pay a dollar or more a thousand cubic feet. Natural gas is splendid for heating the kitchen range, the house furnace, the steam boiler, or for running a gas engine. It has been found chiefly in the Ohio Valley, Oklahoma, Arkansas, Louisiana, Texas, and California. No other country with manufacturing industries has been lucky enough to produce gas where it could be used, although Canada has recently discovered a field which may soon supply the cities of Montreal and Quebec.

When a well contains both gas and oil, the gas sometimes stops flowing before the oil does. Indeed, the life of a gas well is very short. Towns in Pennsylvania, Ohio, and Indiana have been heated and lighted by natural gas. The city officials found it cheaper to let the street lamps burn all day than to turn them off. Industries depending upon natural gas arose. In a few years the gas was gone; the factories were shut down; the businesses were stopped. In one town natural gas was found a few years ago, scores of wells were dug at a cost of hundreds of thousands of dollars, but the whole supply was exhausted in seven months.

The waste of natural gas. Men dig wells for the oil. Often there is no market for the gas (Fig. 229-B), and billions of cubic feet of it have been blown off into the air. Sometimes the wells are lighted so that people can see to work the oil field. Many wells have been allowed to burn for weeks and months and even years—to burn until they are burned out. Thus we have wasted and are wasting the best fuel and the most perishable fuel in the world.

The waste of petroleum. In wasting natural gas, we waste petroleum also. If the gas is held in the ground for a time, it forces the oil out. If the gas is allowed to rush out first, much of the oil can never be secured—that is double waste, and who gains?

fuels, the cheapest and most convenient of all sources of power. In gas. Many homes and factories use this fuel instead of coal. This its bed deep down in old Mother Earth until it comes to light and heat your classmates? The ends of this picture are miles apart.



THINGS TO DO AND THINK ABOUT

How's and why's. 1. How is natural gas formed? Why is it often found with petroleum?

2. Why is natural gas called a *perfect fuel,* and why is it often wasted?

3. What rules do you think we should make for the drillers of oil and gas wells?

Draw a diagram. Show how natural gas can be conveyed to houses and factories.

CHAPTER SUMMARY

A travel talk. Write a story describing a trip that you have taken to a coal mine. Be sure to mention all of the interesting things that you saw.

Make your own questions. Reread this chapter and write the question that each paragraph answers. Compare the questions made by the whole group.

Use figures. Refer to the tables in the statistical Appendix to find answers to the following questions: 1. What proportion of the original amount of coal to be found in the United States has already been mined?

2. Which state in the United States mined the greatest amount of coal from earliest record to the end of 1930?

3. Which of the states had made least use of its coal up to the end of 1930?

4. What country of the world is the greatest exporter of coal?

5. What four countries are the greatest of coal importers? Why?

Fig. A. Tell what this map shows.

Fig. A. Some workmen's dwellings and a part of the *above-ground* plant of an American-owned copper mine in the Chilean Andes. Is there any relation between prosperity at this mine and the farm business in the farming section of Chile and in any section of the United States?

CHAPTER XXIV

SOME OTHER METALS

UNIT 1—ENDURING COPPER, THE CONVEYOR OF ELECTRICITY

Are We Independent? Show that we are getting more or less dependent upon earth materials.

Some qualities and uses of copper. As the pneumatic tire set the world to using rubber, so electricity greatly extended the use of copper.

Copper does not rust or corrode; it can be drawn to a fine wire; it carries electricity well. The copper wires that carry electricity to your house will last a thousand years.

Copper is very useful to electrical and power companies, to plumbers, builders, shipbuilders, to manufacturers of automobiles, radios, and instruments. It also makes a splendid roof.

Copper production has increased as quickly as a mushroom springs up overnight. Some say that it will go down as quickly. One authority, Ira B. Joralemon, a noted mining engineer, says: "The age of electricity and of copper will be short. At the intense rate of production that must come, the copper supply of the world will last hardly a score of years." But another authority, Percy E. Barbour, says that enough copper ore exists to last two generations.

The ancients used copper for making coins and wire. They mixed copper with tin and thus made the imperishable bronze. This metal, now much used for statues, memorial tablets, and propeller blades, was

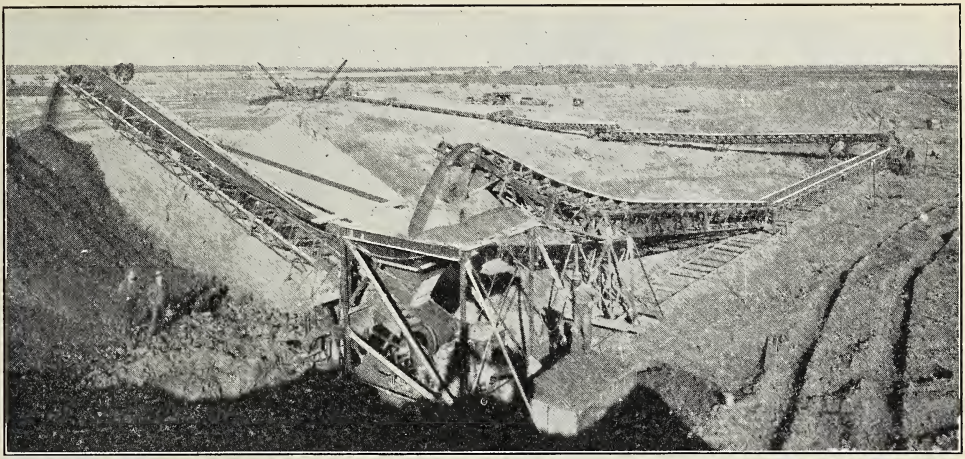


Fig. A. The big mechanical shovels in the background of the picture are scooping up soft earth and dropping it on belt conveyors. If you rode along the belt, you would finally land in the pile of earth at the left of the picture. Low-grade ore and coal are also handled in this way. Man pulls levers; the machines do the work.

in use so long ago that we speak of one of the periods before recorded history as the Bronze Age. The copper mines of Spain have been worked since Roman times.

Copper regions sparsely peopled. Japan, Spain, Portugal, and Germany produced less than a tenth of the world's copper in 1929. Most of the copper comes from places far removed from densely populated areas—arid lands, mountains, forests, where few people live except those mining copper.

The woods of northern Michigan at one time led in the modern copper-mining epoch. Some of her mines, many of which are now a mile deep, yielded pure copper.

Montana soon surpassed Michigan, with the wonderful deposits beneath the great copper hill of Butte through which hundreds of miles of tunnels have been dug. What states have been leaders? (Page 360.)

New processes make new mines. Concentrators (page 209) enabled men to use poorer ores. Then leaching processes were developed, whereby the ore was put into tanks in order to soak out the metal. Ores yielding only 1½ per cent of copper are used by this method. The steam shovel was then improved. As a result, whole mountain sides of low-grade copper ore in Arizona, Nevada, and Africa are now being scooped up and put into cars after the fashion of some of the iron ore of Lake Superior. A copper mine is a favorite form of investment. Americans own mines in Alaska, British Columbia, Mexico, and Peru.

Chile. In the deserts and mountains of Chile are some of the great copper mines of the world. Most of them are owned by American companies, operated by machinery made in the United States, and superintended by Americans. The labor is done by Chileans.

Importance of Katanga copper. The latest great copper "find" is in Africa. The field is known as Katanga and comprises an area 185 miles long and from 30 to 60 miles wide, chiefly in the Belgian Congo, but partly in Rhodesia. The Katanga mines are managed by Europeans and Americans and worked by natives.

THINGS TO DO AND THINK ABOUT

React to words. Here are words that occurred in this chapter. Tell all the things each word reminds you of in connection with this chapter: electricity, bronze, concentrators, leaching, Chili, Katanga, Michigan, deep, investment, steam shovel.

Let figures answer your questions. 1. Do the figures of copper production (page 361) appear to have any relation to Mr. Joralemon's prophecy?

2. Make a graph that compares European production with other continents or countries.

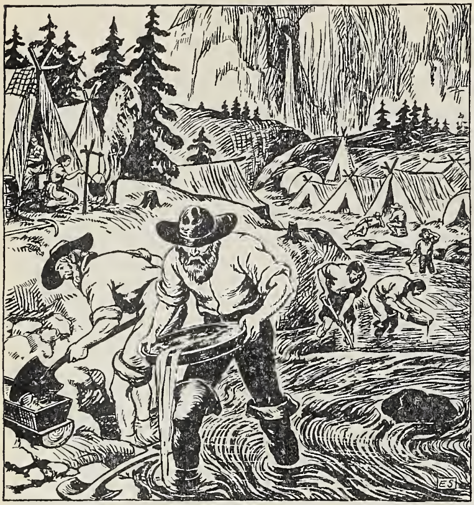


Fig. A. Some of "The Forty-niners" panning for gold in the streams of California.

UNIT 2—GOLD

> THE FUTURE. Tell why you think we shall be mining either more gold or less gold a hundred years from now.

A precious metal. For ages men have loved gold, coveted it, hoarded it. Gold does not rust. It can be drawn into wire, beaten into thin sheets, and readily made into objects and ornaments of great beauty. Long ago gold became money and a means of storing wealth. If you were to dig up a pocketful of gold from a hiding place in your back yard, you could use it for money in every continent. The heads of kings were engraved on coins of gold, silver, and copper, and these coins furnish the only means we have of knowing what many ancient peoples looked like.

The high value of gold and its use for money may give us a false idea of the value of the industry. Compare it (page 361) with the value of the corn or cotton crop (*Yearbook*, U. S. Department of Agriculture) or poultry and eggs.

Gold is easy to mine. Some veins of gold were formed long ago in hard rocks and, as the mountains have been worn away, some of the gold was washed down. Gold, being heavier than the earth and stone, sinks to the bottom of streams. Men have sought this pure stream gold as a great prize. Thousands of people in many lands have scooped up small quantities of gold from the crevices of stream beds and have washed it out of the sand in pans (Fig. 234-A).

Gold ores. The methods of winning gold from the hard, rocky ores are very much like those used in mining copper. Sometimes the gold ore is crushed in mills (called stamp mills). The dust is then blown away and only gold remains.

Gold rushes. The story of the great gold rush to California in 1849 is a very interesting story indeed. Gold was first found in the bottoms of the streams where men worked with pick, shovel, and pan. Then came hydraulic mining (Figs. 235-A and 237-A). Then huge dredges worked over the sand and gravel of deep-stream beds and meadow lands, and finally men followed the streams back into the mountains and found the mother lodes (veins) from which all the stream gold had been washed. Then they began shaft mining on the mother lode.

California gold. The great gold discovery of California in 1848 was the first important gold discovery since 1492. Most of the stream gold was gone in a few years, but the mines on the mother lode still make California the leading state in gold production.

Other gold fields. There was a great gold rush to Australia in 1851, and to the upper Yukon in Alaska and Canada in 1897. But the greatest of all gold fields was discovered in 1886 in the Union of South Africa. Witwatersrand (The Rand), a long range of gold-bearing hills near Johannesburg, has already produced more gold than has been produced by any other field or any other country, even by the United States. In the short time that these mines have been worked, they are already a mile deep. What do these deep, young, gold mines of Africa tell us about the prospect

for keeping on mining gold at the present rate?

Gold mining by airplane. Prospectors recently found gold in the rainy interior of Papua, in a land of sharp, steep, forested ridges and narrow, swampy, jungle-filled valleys. It was almost impossible to build a road either in the swampy valleys or along the steep hillsides, so airplanes were used to carry the necessary machinery to the gold deposits. A sawmill was carried piecemeal, also a dredge, a water-power plant, and motors. By 1933, men were dredging for gold in a roadless forest, using electric power from the near-by stream, and depending on airplane service for their connection with the outside world.

Important gold fields have been discovered in northern Ontario, where active airplane prospecting has been going on for some years.

THINGS TO DO AND QUESTIONS TO ANSWER

If you had been. If you had been a gold prospector in 1849, where would you have gone? in 1851? in 1886? in 1897? Where would you go today?

To mine gold. What is needed?

Leaders in gold production. 1. Look at Table 35, page 361, and from it fill in the blanks with the names of the proper states.

	First Place	Second Place
1880		
Other dates		

2. What curious things do you find from studying the tables of gold production? For example, what part does Europe take in gold production?

For a special report. Read about the gold rush to California in 1849. Tell the class what you have read.

Communities. A thousand men go into a Rocky Mountain valley and start mining gold. Another thousand go into another valley and start farming. Tell about:

1. The amount of trade in the two valleys.
2. The schools in the two valleys.
3. What you would find in each valley fifty years later.

Fig. A. All the sand and gravel from these great holes have been shoveled into the sluice box. The gold stays in crevices in the sluice box.

UNIT 3—SILVER

PROBLEM. China and India use silver money. In 1933 the price of silver went down to a very low figure. What is the effect, if any, upon the ability of China and India to buy goods from the United States?

Andean and Mexican silver. In 1650 the city of Potosí, on the cold and treeless plateau of Bolivia, had more people three times over than were to be found in any city in the United States when George Washington became President nearly 150 years later. Potosí had so many people because of her many rich silver mines. Each year the people had a great *fiesta*, or festival, in which the bishop of Potosí walked down the main street of the city to his cathedral, stepping on sheets of silver.

For the first 300 years after the discovery of America, great stores of gold and silver from the Western Hemisphere went to replenish the meager supplies of Europe. Year after year, Peru, Bolivia, and Mexico sent trains of mules or llamas staggering under heavy loads of silver bars to ports, where Spanish captains loaded the precious cargo on ships that carried it to Spain.

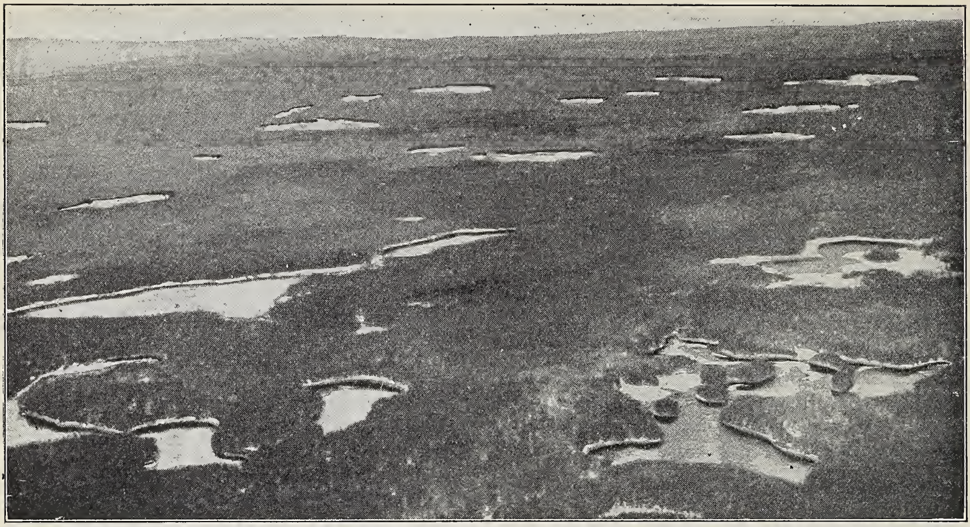


Fig. A. Lakes that are on no map. Lakes without names, hundreds of them, thousands of them, dot the glaciated uplands of Labrador, Quebec, Ontario, Manitoba, and the Canadian northwest territories—one of the great mineral lands of the future. Tell something about two other resources of this vast forest.

Silver ores of the Andes and the Mexican mountains were rich indeed. Only rich ores could be mined profitably in such inland places by the hand labor of Indian slaves using poor tools. In the present age of machinery and new processes many of these mines, from which so much silver has already been taken, are again being worked. Companies whose offices are in New York and London have built railroads and equipped some of the old mines with the best modern machinery. Piles of waste from the old mines are found to contain enough silver to make them valuable by new processes of obtaining the silver.

Some uses of silver. Silver is more abundant than gold and therefore is cheaper, but like gold, it has been used as money in many lands for many centuries. The United States used silver and gold equally as money until 1874. It is still used as money in many countries. Silver is used in many of the arts much as gold is used. Millions of pounds of it are used in photography and also for tableware.

In India, silver serves as a kind of famine protection. The native who sells a crop and gets a little money he does not need at the time buries the silver. Later, if his crop fails, he digs up his silver and with it buys food, while his less fortunate neighbor may perish of the famine.

Silver ores and mines. In many mines silver ore is found with copper or with lead or zinc. Some ores yield three of the metals in varying amounts.

The northern peninsula of Michigan and the neighboring part of Wisconsin are part of an old rock formation that was once buried deep under mountains. Here are the great iron (page 213) and copper mines (page 233). The same formation also covers a large area in Ontario and other parts of Canada recently important for mining silver and gold. Ontario, with its wide areas of old twisted rocks, also has the greatest nickel mines in the world.

REVIEW

1. On a map locate six places important for silver production.
2. Write a dozen completion questions for your classmates to answer about this unit.
3. Find material about Cortez, Pizarro, or Sir Francis Drake. Make a report to the class.

UNIT 4—LEAD, ZINC, AND TIN

PROBLEM. Since people will doubtless live in this country for thousands of years, what do you think should be done about the continued use of tin foil, and of metal tubes for toothpaste?

Lead. Lead melts easily and bends almost like string. These two qualities make lead very useful to the plumber. Lead is useful also for making tubes for holding toothpaste, shoeblacking, and many other things. Most of the type used in printing is made of lead and antimony—a metal that comes from China. Common solder is an alloy of tin and lead.

Zinc. Zinc does not rust as iron rusts; therefore we cover layers of the quickly rusting sheet iron or wire with zinc and call the product *galvanized iron* or *galvanized wire*. When covered with zinc, iron lasts much longer than does uncovered iron. Lead and zinc are often found in the same ore. These ores are handled in much the same manner as copper ore. The chief lead supplies come from the mines of Missouri, Idaho, and Utah; zinc comes from New Jersey, Oklahoma, Kansas, and Utah. Zinc and lead are widely used in making paint.

Tin. Tin is soft and easily worked. Thin layers of it are spread on thin sheets of iron by heavy rollers at a rolling mill. This makes the very useful tin plate so very widely used for tin cans. Tin foil is pure tin alloyed with a little lead. Tin foil is used for wrapping cigarettes, candy, chocolate, food, and other small articles, and for making tubes for holding creams and pastes.

Tin mining. The Malay Peninsula has great deposits of sand and gravel which carry tin as California creeks once carried gold. Tin was washed down from a mother lode much as the gold of California was washed down from its mother lode. Thousands of Chinese with pans and sluices work over the tin-bearing gravel, and produce an important part of the world's tin supply.

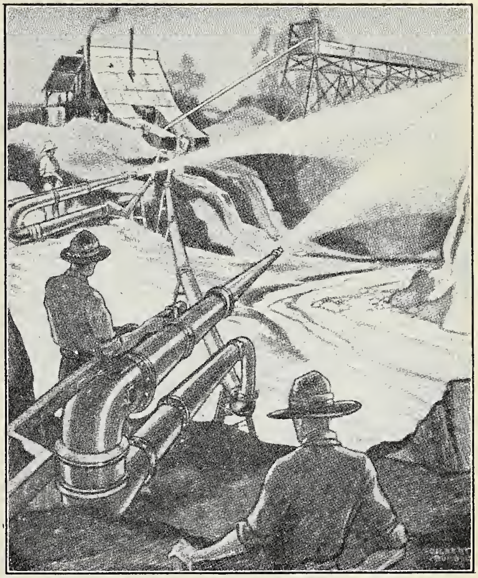


Fig. A. Placer mining. Water under pressure washes down gravel banks bearing gold or tin which is caught in sluice boxes (Fig. 235-A).

Of late, machinery has been used in tin mines, much as in other mines. The dredge may sit in a meadow pond but little larger than itself. The dredge shovels out the meadow in front of itself, passes the dirt back through its sluices, drops it out behind, leaving a little tin in the crevices of the sluice boxes. The dredge I visited in Malaya was almost terrifying. It roared and shook as stones as big as my head went bumping through it.

On the cold plateaus of Bolivia there are mines of tin ore that are worked in the same way as are the mines of copper, gold, and silver.

THINGS TO DO AND QUESTIONS TO ANSWER

Copy the chart and fill it out.

NAME OF METAL	USABLE QUALITIES	WHERE FOUND	USES

For class discussion. 1. Are all of the metals mentioned in the chart found in the United States?

2. Should there be any laws concerning the use of tin and lead?

UNIT 5—ALUMINUM, THE GREAT HOPE

PROBLEM. After you have read the unit, tell why this title was chosen.

The abundance of aluminum. The earth's crust contains more aluminum than any other metal. Despite its abundance, aluminum, now made from the richest of ores, is a costly metal. Not long ago it was much more costly than it is now. New processes of smelting reduced the price of aluminum a few years ago to a fraction of what it was formerly (page 370).

Many a common clay bank contains from 25 to 35 per cent of alumina (aluminum oxide), but the aluminum is so mixed with sand (largely silica) and other impurities that it is difficult at the present time to get the aluminum out at reasonable cost. In the United States the purer form of alumina, called *bauxite*, the ore from which aluminum is now extracted, comes mainly from Arkansas. The United States, however, produces only 20 per cent of the ore necessary for the world's supply of aluminum, but makes 35 per cent of the metal. Therefore, ships bring this precious clay to us, chiefly from the jungles of British and Dutch Guiana, where European companies have built villages for Negro workers and are doing their best to keep the people healthy in a bad climate.

Smelting. The world's supply of aluminum is smelted under the great heat of the electric spark in the electric furnace (Fig. 315-B). This takes a great deal of power; therefore, aluminum smelting is done chiefly near cheap and abundant water power. The largest smelting plant in the United States is at Massena, New York, where much of the bauxite from overseas and from Arkansas is smelted by St. Lawrence River water power. Norway, Switzerland, and the Alpine part of France also smelt aluminum.

Can the usefulness of aluminum be extended? Aluminum does not rust; it is a good conductor of electricity; it is light in weight; there is plenty of it in the earth's crust. Aluminum carries electricity well and can be used in electric work in place of copper. It is very important to the manufacturers of airplanes. It is used in great quantities in making automobiles and it might be a good substitute for iron if it were not so soft. The prospect of its supplying the metal shortage that threatens in the other metals depends upon three things: first, learning how to get aluminum out of a common clay bank cheaply; second, learning how to harden it; third, learning to make new alloys with other abundant substances that will make aluminum hard and strong. Many men are working on these problems.

THINGS TO DO AND QUESTIONS TO ANSWER

A contest. See which person in your class can make the longest list of articles made from aluminum. In order to put an article on your list, you must know the use to which each article is put.

Trade. What does the table (page 361) tell you about trade?

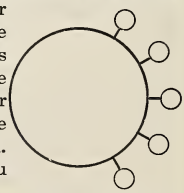
CHAPTER SUMMARY

For your museum. Add samples of the minerals mentioned in this chapter to your museum collection.

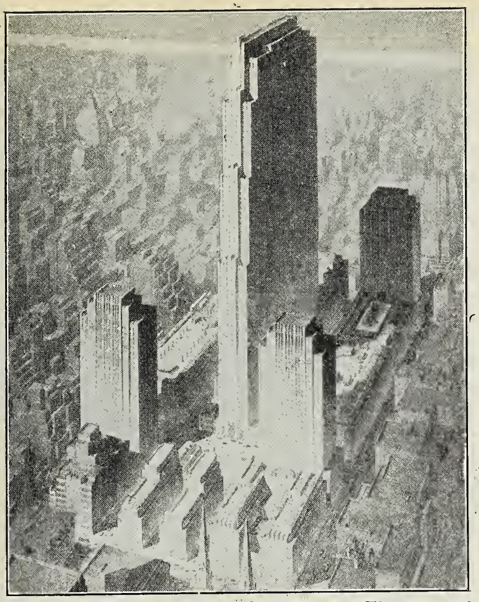
Picture study. Examine carefully every picture in this chapter and tell what each shows about mining, about living, about work, and about *investment*.

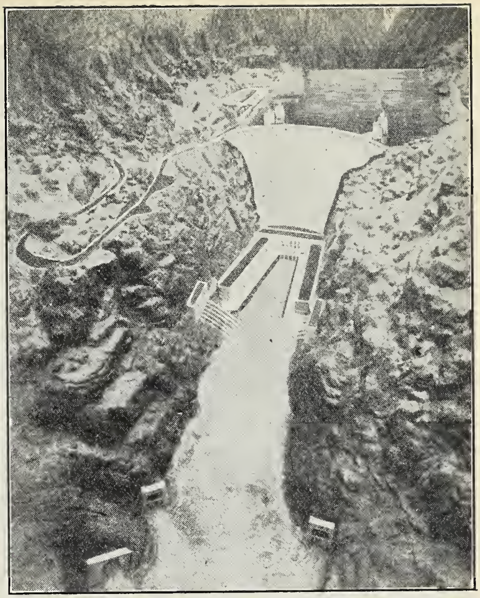
Discussion and ideas. With the help of your teacher list on the board all the problems raised in this chapter. Assign yourselves to small groups, each one to discuss one of these problems. One person may report for the group or each person may talk about one point. See how much information you can get on your problem from newspapers, magazines, and books other than your textbook.

A circle contest. Make a large drawing of this model on a large piece of paper or on the blackboard. Place the name of one of the minerals studied in this chapter in the large circle. In the smaller circles place the name of some article made from the mineral. How many circles can you make?



Do the same thing for each mineral mentioned in this chapter.





Figs. A and B. Some uses for cement. The mass of buildings at the left, called Rockefeller Center, is almost too big to believe. It covers 12 acres of ground in the heart of New York. It is the largest and finest building enterprise in the city which is the commercial, industrial, and financial capital of the Western Hemisphere. ¶ At the right is a working model of Boulder Dam and its power stations. Tell about cement in this dam.

CHAPTER XXV

SOME OTHER MINERALS

UNIT 1—CEMENT

> A Study in Service. What are the advantages or the disadvantages to a country in the use of good concrete for a century?

What is cement? Cement of the kind called *Portland cement*, invented in 1825, is made by burning certain amounts of broken limestone and broken shale rock or clay for a short time in a very hot fire. This dries out all the moisture. The stuff is then ground very fine and mixed thoroughly. When again made wet, it hardens and will stick to many substances. It will not burn, rust, or crack with heat or cold. Cement making is now a job for dynamite, steam shovels, power crushers, and other mass-production machinery.

The Romans knew how to make and use cement, but their cement was not so good as ours. I have seen bits of Roman brick wall in North Africa that had fallen into the Mediterranean Sea, where the beating waves had eaten out all the bricks but left a perfect framework of cement.

Recently it was discovered that steel and cement, when heated, expanded to the same extent and at the same rate. Because of this fact, a framework of steel can be imbedded in a mass of cement and broken stone, called *reinforced concrete*, and become a solid and durable mass. The steel framework, serving as bones to the body, gives great strength to the structure.

Perhaps the greatest single service of concrete is in the building of dams. If a good foundation in rock can be found, cement and stone can be dumped in until the mass is so large and so strongly placed that no flood can possibly move it. Cement goes into every crevice of the bedrock and thus makes the dam water-tight (Fig. 239-B). This gives us new power to control rivers.

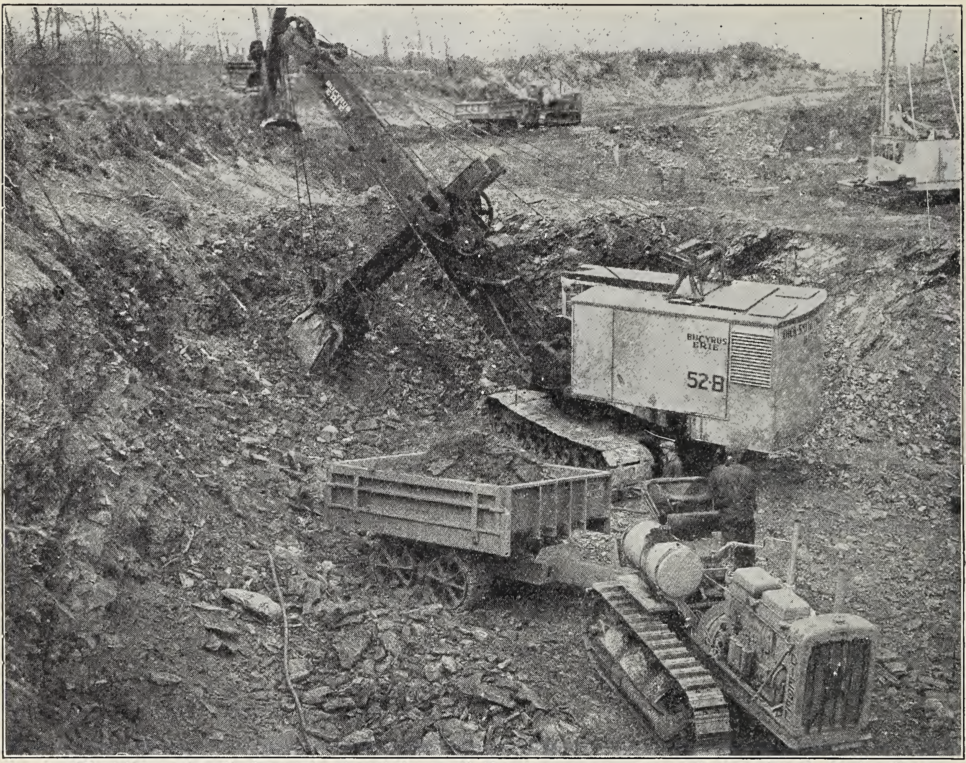


Fig. A. Blast this rock with dynamite, shovel it up with the steam gas engine or electric shovel—that is the way we handle earth and rock in the age of science and machinery. One man using this shovel can handle as much dirt as 250 men with hand shovels, and it can lift pieces that man cannot handle.

Many persons have, not improperly, called this the *age of concrete.*

Manufacture of cement. Limestone and clay are found and are easily quarried in almost every state and country. Coal, oil, or natural gas is to be found in many parts of the United States. Cement is heavy, therefore the freight rate becomes an important part of the cost if cement is carried a long distance. For this reason cement plants are to be found in nearly all sections of the United States and in thirty-five of the states. When the Roosevelt Dam (Fig. 31-B) was built in the hills of Arizona, a road was first built into the mountains and a cement plant was erected just where the cement was wanted.

The greatest center for making cement is near Allentown, Easton, and Bethlehem, in eastern Pennsylvania. Here limestone and shale are found side by side and coal is not far away. This district has become the greatest center because it is near large cities and the ports of Baltimore, Philadelphia, New York, and Buffalo. California and Michigan are next to Pennsylvania; but, with plants both east and west, Pennsylvania exceeds both these rivals.

Cement in foreign lands. As in the United States, so in Europe there are cement plants on or near every important coal field. There are eleven plants in Czechoslovakia. Belgium, having a good labor supply, the materials close to one another and close to excellent harbors, is one of the largest cement exporters in the world.

Cement in a nutshell. Write the life story of a sack of cement.

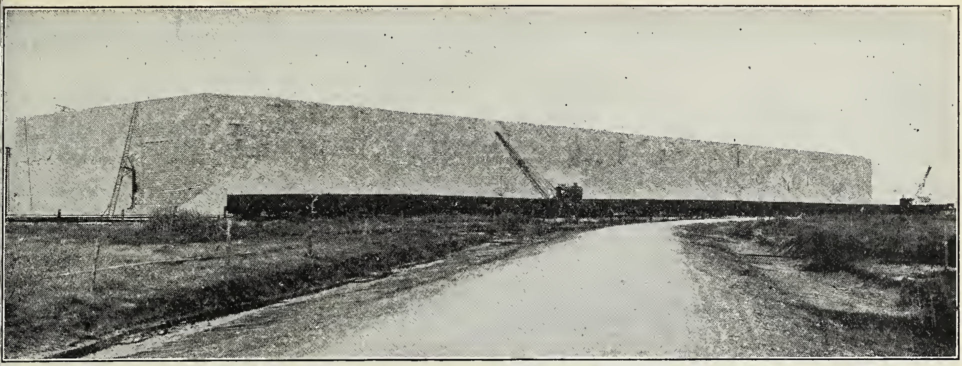


Fig. A. The big block of stuff which you see in this picture is sulphur which has been taken from a Texas mine and is awaiting shipment. The mechanical shovel is loading the sulphur on the freight cars.

UNIT 2—SULPHUR

> FIND THE SULPHUR. Who can make the longest list of useful things in which sulphur has a part?

Sulphur in ores. Sulphur unites with many substances. One of the problems of the metal industries is to get rid of the sulphur in ores of copper, lead, zinc, silver, and other metals. Great heat drives off sulphur in the form of fumes which kill all vegetation for miles. A copper-refining plant at Ducktown, in the beautifully forested country of Tennessee, made the ground entirely bare of vegetation. Without the protection of plant roots the whole countryside began to wash away. Fortunately, sulphur fumes are harmless when used to make sulphuric acid, a form in which sulphur is of use in hundreds of chemical works.

Pure sulphur. Many volcanoes send out sulphur fumes; some volcanoes deposit pure sulphur. The Italians, working with pick and shovel in the old volcanoes of Sicily, gave the world its supply of pure sulphur for a long time, but the more easily mined deposits of Texas have made a great change in the world's sulphur supply (page 361).

The uses of sulphur. If you should go through a hundred chemical factories, you would find most of them using sulphur for some purpose. Thousands of tons are used in refining petroleum, and also in rubber factories. The pulp mill which turns chips into fiber and then into paper could not do it without the aid of sulphur. The rayon plant which copies the silkworm's trick of digesting cellulose, making it into jelly, and then into thread, uses sulphur in the process of digestion.

Sulphur is used in making fertilizer, and thus plays an important part in the food supply of the American people. Phosphate rock is a rock which contains phosphorus left from the bones of animals that died long ago. This phosphorus is necessary food for plants. To make it ready for their use, phosphate rock is treated with sulphuric acid in a fertilizer factory. It then becomes *superphosphate*, the most widely used commercial fertilizer. Plants will eat it almost as quickly as you eat sugar.

Sulphur is also used to kill fungus on the leaves of fruit trees. When exposed to the air, the liquid carbon bisulphide turns to a deadly gas, which is much used in fumigating wheat and seeds in order to kill insects. This gas is powerful enough to kill a chestnut worm inside the nut.

The chief source of sulphur. Texas now has almost a monopoly of the world's supply of pure sulphur. This is because an artesian well can be dug down into the sulphur layer. Pipes are placed inside the well, where they do a marvelous trick. One pipe carries superheated steam which melts

Fig. A. Salt making in the Philippine Islands. The brine from the salt mines is allowed to evaporate in large pans, leaving the salt crystals.

the sulphur. The next pipe carries compressed air which blows the melted sulphur out through the third pipe, very much as natural gas blows petroleum out of the rock layers. The melted sulphur cools and hardens into great piles almost like mountains. The sulphur is broken up by blasting, loaded with steam shovels, and taken to the factory. This process, the experts say, is too good to last long, because in a short time the supply in Texas and Louisiana will be exhausted and we shall have to depend upon the sulphur ores.

Reclaiming a by-product. When smelter fumes killed vegetation, laws were passed compelling the smelters to stop it. Then they learned how to make sulphuric acid from this waste product. Scientific study has shown the way to make hundreds of useful products from things that had been waste.

THINGS TO DO AND QUESTIONS TO ANSWER

How well did you read? 1. What state has almost a monopoly of pure sulphur?

2. What surprising things does the table on page 361 tell you about sulphur production?

3. What will sulphur fumes do to vegetation?

4. From what is sulphuric acid made?

5. What is superphosphate?

6. When our supply is exhausted, how can we then secure sulphur?

7. Who can make the longest list of uses for sulphur?

UNIT 3—ASBESTOS, SALT, POTASH, NITRATE OF SODA, AND GYPSUM

> A Bit of Reasoning. Show how salt deposits prove that climate has changed.

Asbestos. Dissolve a bit of salt in some water. Evaporate the water. You will find the salt in the form of *crystals*. Asbestos is a crystal unlike any other crystal in that it is so long and stringy that it can be spun into thread and woven into cloth. Asbestos is sometimes called mineral wool. It will not burn, and, therefore, serves many purposes that no other fiber can serve. Men who tend the hot furnaces wear gloves of asbestos. Asbestos is used chiefly for insulating material to keep heat from escaping from steam pipes and boilers.

World-wide salt. Salt is greatly desired by every people. Many animals will walk long distances to get a lick of salt. Every river carries a little salt to the sea, and sea water itself contains salt to about 3 per cent of its weight. It is an easy matter to get salt in seacoast countries having a dry season. Make a little pond of sea water, let the water dry up, then scrape up the salt that remains in the bottom of the pond. This is done on the shores of Spain, Italy, southern France, India, Arabia, some of the West Indies, San Francisco Bay, Great Salt Lake, and in many other parts of the world.

Rock salt. Long ago Nature seems to have dried up whole arms of the sea, leaving thick layers of rock salt which, when uncovered, can be mined like any other mineral. Buried layers of rock salt are found in Germany, Austria, France, England, Kansas, California, and in many other places, but especially in the Lakes region of the United States—Michigan, New York, and Ohio—and in Texas. Rain water which soaks into the earth in these localities may come out as a spring of salty water. The Indians evaporated such water

and obtained salt before the white man came. Evaporation of salty spring water was taught the people of northern England by the Romans.

Today men dig wells to get salt water. They open a mine and dig rock salt. Nearly all of our rock salt is mined in New York, Michigan, Kansas, and Louisiana. By a method even more simple, a pipe is sunk into the ground and water is sent down. The water dissolves the salt, the brine is pumped out or runs out of the well, and the water is evaporated. By this piping process, hundreds of thousands of tons of salt, in the form of brine, run each year into chemical works in Syracuse and other cities in the Lakes region, to be manufactured directly into soda ash and other chemicals important in the household and the factory.

Potash and nitrate of soda—mineral neighbors of salt. The same conditions that made salt deposits seem to have made deposits of potash and nitrate of soda. The great potash deposits of Germany and Alsace (Rhine Valley, France) have layers of salt associated with them.

Once upon a time, the desert of northern Chile seems to have been an arm of the sea, and much sea water appears to have evaporated there. The ground is now white for miles with layers of salt and also with layers of nitrate of soda. Dirty nitrate is shoveled into tanks of water where the *nitrate* dissolves. The water is then evaporated.

Gypsum. This soft white mineral—one of the combinations of lime—is found in large beds in many parts of the world. It is used to make plaster of Paris, some kinds of cement, and for filling of wallboards which are used increasingly in inexpensive buildings. The United States, Great Britain, France, and Canada are the chief producers of gypsum.

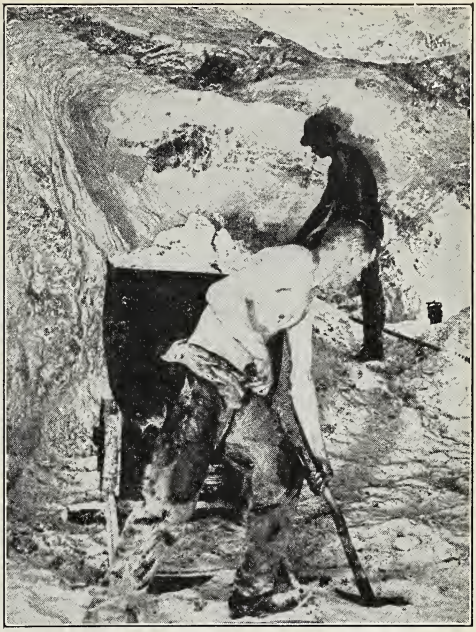


Fig. A. A thousand feet underground in a German potash mine.

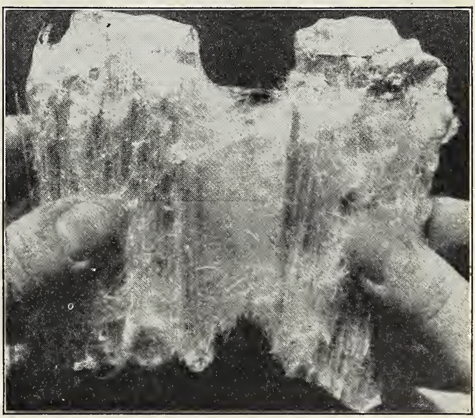


Fig. B. Asbestos-bearing rock just as it comes from the mine.

THINGS TO DO AND THINK ABOUT

Some salt problems. You should know first that a cubic foot of sea water weighs 64.3 lb., that 3 per cent of its weight is salt; a mile is 5280 feet.

1. How much salt in a cubic foot of sea water?
2. How much salt in a cubic mile of sea?
3. Name three ways of obtaining salt.

An extra-hard one. How much salt is there in the sea if there are 150,000,000 square miles of sea surface averaging one mile in depth?

Extra credit. Write to United States Geological Survey for list of recent publications on our potash industry. Get one and make a report to the class.

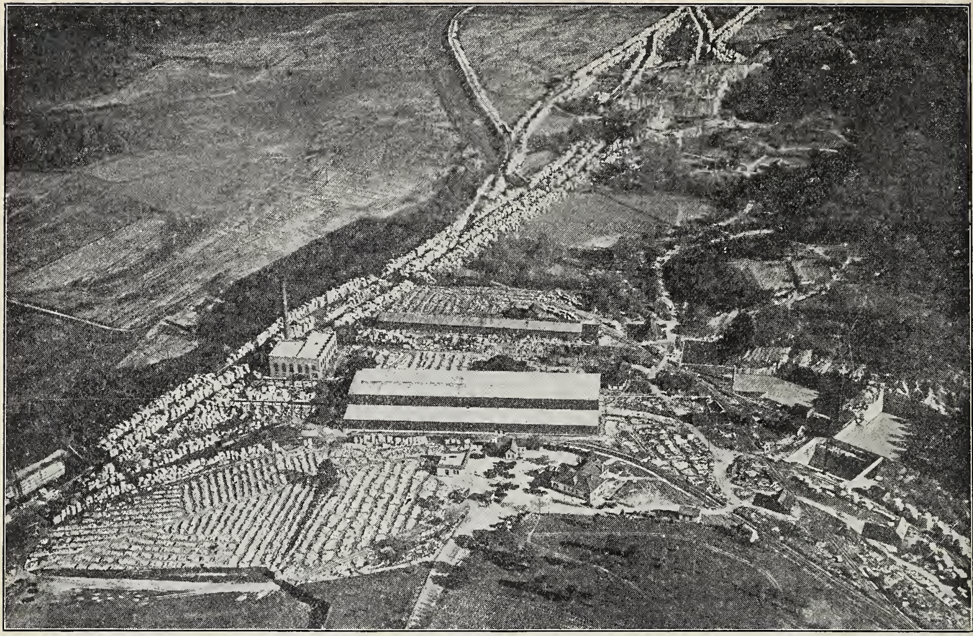


Fig. A. One of the plants from which the beautiful Georgia marble comes. At the right are quarries. In the center are the buildings surrounded by yards of cut marble.

UNIT 4—BUILDING STONE, SAND, AND GRAVEL

Meeting Conditions. Show various uses of stone and sand to men making their living by different methods.

Sand and gravel. While there is some sand in almost every soil, this useful building material is found, due to the action of water, in greater amounts in certain places. Waves beating upon the shore carry away the lighter particles of earth and leave tens of thousands of miles of sandy beach. Rivers and smaller streams, carrying their load of earth and sandy material, drop the heavier sand and carry the lighter material farther. Thus sand is deposited at a certain place in most streams and there it forms a sandbar. You can get sand at the same place after every flood. Building sand is one of the most useful and widespread earth materials. If the water that makes sandbars flows swiftly, it leaves beds of gravel instead of sand. In many building operations, cement, sand, gravel, and broken stone are mixed together to form concrete.

Stone suitable for building. Stone is less common than sand. Flood plains and coastal plains, both built by running water, usually do not contain building stone. Ascend the Mississippi River and its mighty branch, the Arkansas River, to the city of Little Rock, and you will not find a single stone that Nature has made. Little Rock got its name from the fact that, as explorers ascended, they found the first stone at this point.

Except for flood plains, most places in the world have within a short distance some stone with which men can build a rough wall. Certain stones are especially suitable for making buildings. Such stone is sometimes quarried (taken out) and sent to distant markets.

Soft stone. A stone called *Bedford limestone* is quarried in great quantities in Indiana and shipped to distant places because the stones come out of the earth soft,

almost like cheese. Such stone can be made into any desired shape, after which exposure to the air hardens it.

Hard, durable granite. Granite is the original mother rock of which the earth seems to have been made. Granite is found deep under the base of many mountain systems. Granite is very hard and very durable. It is quarried largely on the coast of Maine because it is there exposed on many a hillside close to good harbors, whence boats can carry it cheaply to New York and many other ports. Granite quarries in Massachusetts and Vermont are near to many cities. Those in North Carolina, California, Minnesota, and Wisconsin are each near to a large market or to a large area having no granite.

Norway has the same advantage that Maine has and exports small quantities of granite to Great Britain, Germany, the Netherlands, and even to Argentina as return cargo for the wheat ships.

Beautiful stone. Marble, both white and of many beautiful colors, is the most highly prized of all building stones. While marble is found in many places throughout the world, it is quarried in a few places where the stone is of unusual quality or where an easy means of marketing exists. In the United States, Vermont and Tennessee produce about equal amounts, but fine marble is also produced in Georgia, Colorado, and Maryland.

The pure white marble of Carrara, Italy, is perhaps the finest marble in the world. It is used for statues, and can be found in almost every sculptor's shop and every museum. In the Library of Congress at Washington, marble from Algeria, Belgium, Greece, Italy, Alaska, Georgia, New York, Tennessee, and Vermont was used.

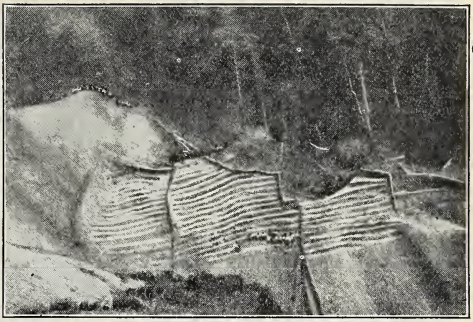


Fig. A. Man uses many more metals and minerals than we have space to tell about in this book. They come from almost every corner of the world. This picture shows one of the few emerald mines in the world. In the tropic forest of Colombia, South America, the men are digging down the hillside where some unusual thing in nature caused the formation of those beautiful crystals, emeralds so highly prized as jewels.

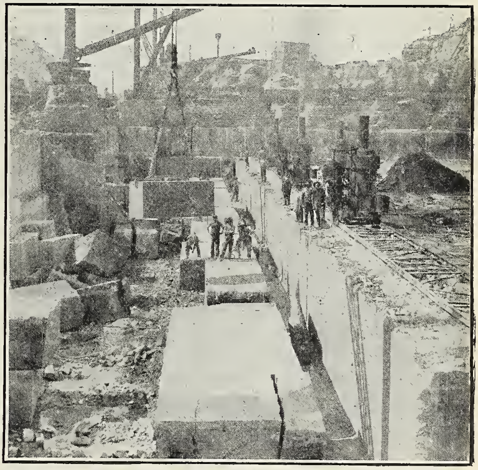


Fig. B. A small section of a limestone quarry at Bedford, Indiana. The cuts shown in this picture are about eleven feet deep.

THINGS TO DO AND THINK ABOUT

Use your dictionary. Find the meaning of: quarry, durable, beach, ascend, and statue.

For your investigation. Find buildings or objects in your neighborhood in which materials mentioned in this unit have been used.

Hold a class discussion. Discuss the topic at the beginning of this unit.

CHAPTER SUMMARY

For your museum collection. Add samples of the minerals mentioned in this chapter to your collection of minerals.

The stones speak. Choose six members of your class and let each one represent one of the following. Watch for anything that was left out of the report.

I am sand.	I am granite.
I am limestone.	I am marble.
I am building stone.	I am cement.

What have you to say about conservation of sand, gravel, and cement?

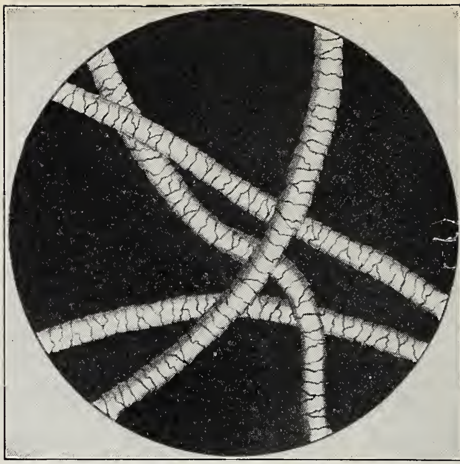


Fig. B. Fibers of wool much magnified. The scales cause them to make yarn easily and also to stick together in the form we call felt.

Fig. A. Macedonian woman spinning flax with the whirling stick. Her left hand regulates the size of the thread. The stick on which the thread is wrapped and tied with a half hitch spins like a top and does the twisting. This is the distaff, so often spoken of in old English writings. I have myself seen women doing it in villages in Italy and Persia and in the tents of the Bedouin in Algeria and Iraq.

CHAPTER XXVI

TEXTILES

UNIT 1—A WIDESPREAD INDUSTRY BECOMES CONCENTRATED

PROVE THIS. "Times are not like they used to be," said an old man. How might he back up that statement by telling about the textile industry?

Clothing. Without clothing man could not live in most of the places where he now makes his home. The first clothing was probably the skins of animals, but long ago men learned to twist wool and plant fibers into thread or yarn (Fig. 246-A) and to weave the thread into cloth (Fig. 248-A).

Textiles. The term *textile* includes all kinds of cloth and knit goods. Therefore, we have textile factories making cloth of wool, cotton, silk, rayon, flax, jute, ramie or China grass, and asbestos. We might divide fibers into three classes: animal, vegetable, and mineral.

A hand industry. In the poem, "The Courtship of Miles Standish," Longfellow tells us that spinning and weaving were done in the colonial New England home. At that time the manufacture of cloth was a home industry in all continents. It had been so for centuries, and the method still survives in millions of homes in China, Japan, and many other countries.

The English cottage industry. In England in the eighteenth century many people lived in the country. Each family usually had a little cottage with a few acres of land, a cow, pigs, and chickens. The family raised most of the food its members used. The man was a spinner or a weaver for most of the year, but in harvest season he worked on neighboring farms.

The Industrial Revolution. About the time of our Revolutionary War, certain Englishmen named Hargreaves, Cartwright, Crompton, and Arkwright invented machines that spun thread and wove cloth by mechanical power. At first these new machines were driven by water power.

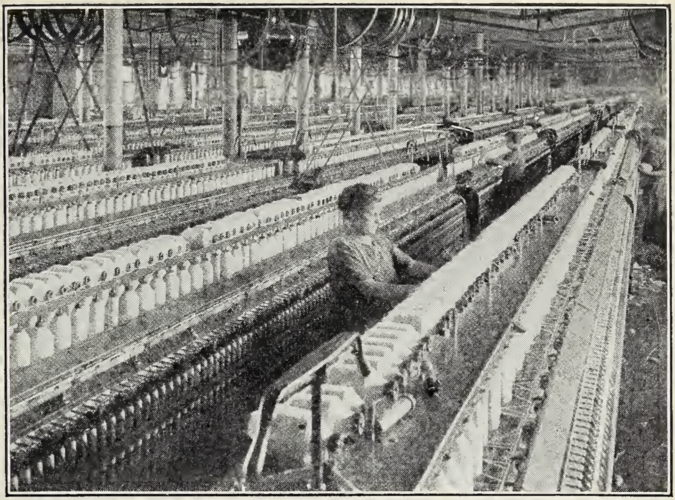


Fig. A. Mass production of yarn. In place of one spinning stick of the old distaff (Fig. 246-A) the modern spinning machine has 600 to 800 spindles and one spinner attends to them all. How long is this room?

Water wheels were erected on many small streams that flowed from the mountains in the center of England. The eastern streams provided power for woolen mills in Yorkshire. The western streams did the same for Manchester. This district was near Liverpool, a port for cotton import. The west winds blowing in from the sea brought much rain which filled the streams and made the air damp. In dry air cotton threads are filled with electricity and kink. In damp air the threads are straight and can be woven more easily. This was an important fact in the beginning of the industry. Air in mills is now dampened artificially.

In a short time after the machines were invented the British cotton industry outgrew the small water-power mills of the Lancashire region, but fortunately coal was at hand to drive the engines. Because of her coal fields, England was able to develop factories to such an extent that English cotton goods went wherever British ships could take them. Her woolens, too, were famous in many lands. The United Kingdom had a great industrial boom. Her cities grew, she imported food, and she became a great manufacturing and exporting country. By the middle of the nineteenth century, England called herself "the workshop of the world."

The machines are introduced into America. Shortly after the factory system began in Britain, some British machine makers came to New England. There they made machines like those used in old England.

New England was ready for this industry. She had rich men who had made fortunes in fishing and whaling, and who were glad to invest money in the new factories. The New England air, blown in from the Atlantic, was damp enough for satisfactory weaving. To furnish power for the machines, New England had many waterfalls on many small streams. Many of these water-power sites and early mill towns were close to the ports where ships could unload cotton from Charleston and Savannah, and from which they could carry finished goods to many American ports. New England was also near to the ports at which immigrants from Europe arrived. As a result, her cotton mills grew almost as fast as those of England had grown.

In time, many factories needed more power than could be supplied by water wheels and so some coal was used. Boats bringing coal from Norfolk, Baltimore, Philadelphia, and New York Bay could land it close to the mills in Providence, New Bedford, Boston, and many other ports. Then New England became a land of cities much as old England had become. There are now huge cotton mills with hundreds of workers in Fall River, New Bedford, Holyoke, and Lowell, Massachusetts; Paw-

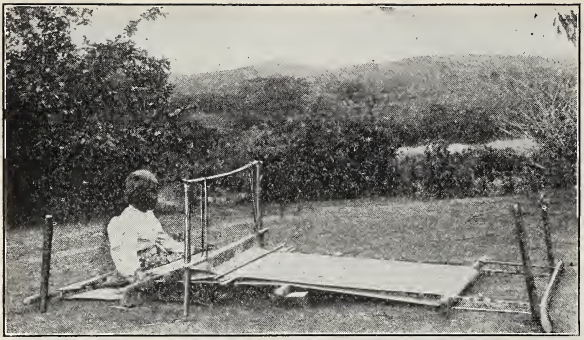


Fig. A. This woman in Madagascar, dressed up in European clothes, is weaving by a method thousands of years old. The long threads that run toward this woman are called *warp*. You can see the *woof* thread is passed between the warp threads. Modern machine looms are automatic, so that one weaver can attend to dozens of them—*mass production of cloth* (Fig. 287-A).

tucket and Providence, Rhode Island; Manchester and Nashua, New Hampshire; and in many other towns.

Several different businesses. It is unusual for one mill to take bales of cotton and make finished cloth. It is much more usual for one mill to spin yarn and for another mill to weave the yarn into cloth. The cloth then goes to the bleacher. In former times the cottage weaver spread the cloth upon the grass of the fields so that the sun might bleach it. Bleaching is now done in buildings by chemical processes. Today there are factories that do only bleaching. In the early days the lakes and ponds of New England furnished the large quantity of clear water that was needed for bleaching.

Cloth goes to the dyer to be colored. Some goes to the printer, where figures are printed on it by machinery. For ages, in all countries, cloth had been printed by hand, which means that the printer used a block of wood upon which a design had been carved. He dipped the carved block of wood into dye and pressed it on the cloth in somewhat the same way that we use a rubber stamp.

SEARCH YOUR OWN MIND

A good set of questions. See which member of the class can write the best set of questions to get the important things out of this unit.

UNIT 2—A TEXTILE INDUSTRY DEVELOPS IN THE SOUTHERN STATES

Locating a Factory. A company wishes to operate a cotton mill either in New England or in the South. What arguments can you offer in favor of each place?

The new era of machinery. The spinning and weaving machines in use before 1880 required much more skill in operating them than do the later models. More efficient machinery made it possible for the cotton industry to spread to almost any country that would buy machinery from New England or old England.

The old loom required very careful watching. If a thread broke and the operator did not see it, the result was a bad flaw in the cloth. Today the automatic looms very kindly stop and wait the moment a thread breaks. About all the operator has to do is to put in spindles of yarn and tie knots when the threads of yarn break. The machine does the rest and winds the cloth into a great roll. Sometimes one weaver tends 40 looms or even more. Of course the textile factory needs machinists, electricians, chemists, and managers, but most of the workers require far less skill than was necessary in the early days of machinery, and still less than was needed on the hand loom of our great-grandmothers.

The cotton industry in the Southern States. Our Southern States have great resources for cotton manufacturing. The cotton field and the factory are close together. I have seen cotton growing in Georgia just outside the cotton-mill window.

Power costs less in the South than in New England. The Southern Appalachians are high and have a heavy rainfall both winter and summer. Many streams flow down across the Piedmont and the Atlantic Coast Plain and give opportunity for power plants to send out thousands of horse power

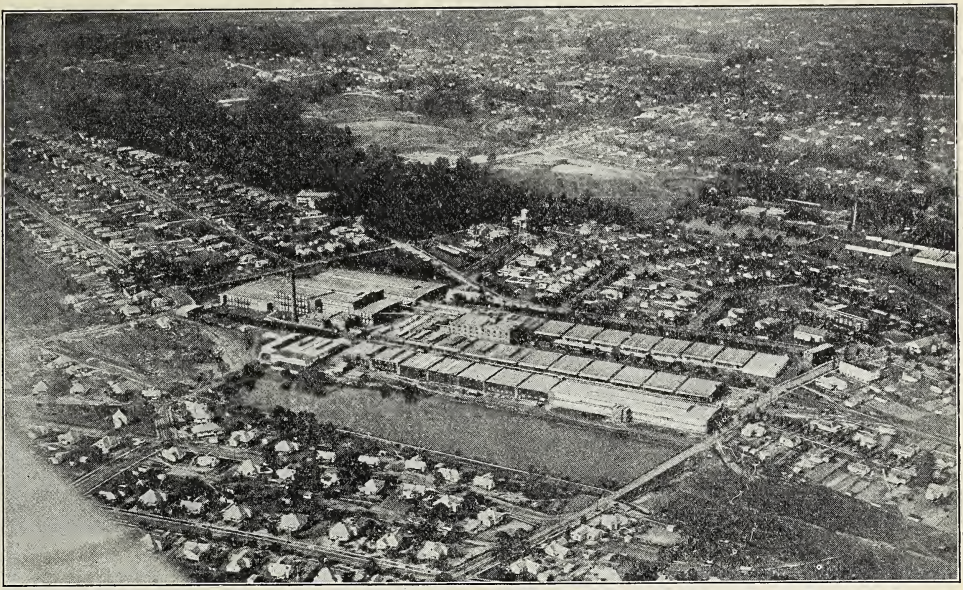


Fig. A. Mills and villages much like this may be seen in Virginia, North Carolina, South Carolina, Georgia, Alabama, and Tennessee. This is a good illustration of mass production of yarn, cloth, and knit goods. What does the picture show you about the cost of living?

of electric energy. If power derived from water is not enough, the coal fields are not far away.

The people in the Southern mountains and in the neighboring tobacco regions have small farms and large families, so there are many workers to go into the cotton mills. They work for lower wages than people do in Massachusetts. One reason for this is that the cost of living is less in the South. Houses may be built for less money because the winter is not so cold, and the fuel bill for heating the house is less. Clothing costs less; one scarcely needs gloves or a heavy overcoat. (Fig. 249-A.)

Many of the Southern mills are located in country towns where the worker can have a garden. The long growing season there gives him a chance to raise more vegetables than could be grown in a New England garden.

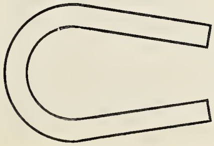
The Southern coast states have many good ports and navigable rivers, and in the twenty years, 1880–1900, their railroad mileage increased 166 per cent.

Labor and the cotton output. The Southern workers, unaccustomed to the new industry, were not so skilful as those of the North, so at first they made the coarser kinds of cloth. But year after year the workers became more skilful and made finer cloth. In a recent year North Carolina manufactured cotton goods of greater total value than Massachusetts did.

There are very large mills at Charlotte and Greensboro, North Carolina; Spartansburg, Greenville, and Columbia, South Carolina; Atlanta and Augusta, Georgia, and many smaller towns.

THINGS TO DO AND THINK ABOUT

A new textile center. The new South is acting as a magnet in pulling textile factories to it. Copy the following chart on a large piece of paper and fill in the blanks with reasons why the factories are being pulled to the South.



1. ______________
2. ______________
3. ______________
4. ______________
5. ______________

Fig. A. Girl operatives making stockings in a large hosiery mill in North Carolina.

UNIT 3—THE TEXTILE INDUSTRY SPREADS TO MANY LANDS

A QUESTION FOR THE BRITISH AND OTHERS. Will the United Kingdom continue to be the workshop of the world?

An industry easy to start. A group of men with some capital, wishing to start a cotton mill in Winnipeg, Buenos Aires, or Cairo, would find the task relatively simple. If they are starting a weaving mill, they can buy looms in the United States, Great Britain, France, or Switzerland and hire a few weavers to teach the people to make cloth. Yarn can be bought from many countries. Great Britain exports yarn far and wide, even to distant China.

Britain's European rivals. Cotton factories similar to those of Great Britain and the United States have been built in France, Germany, Belgium, Holland, Denmark, Czechoslovakia, Switzerland, Italy, Spain, and Hungary. The people of these countries operate machines well. The textile manufacturers of these countries supply most of the needs of their own people. In some cases goods are made for export. Textiles are important exports from France, Germany, Italy, Switzerland, and Czechoslovakia.

Brazil. Brazil has placed heavy tariffs upon imported textiles. Textile machinery was bought in Europe and hydroelectric plants were built. Now Brazil manufactures most of the textiles she uses. In 1840, Great Britain took two thirds of the raw cotton export of the United States; now she takes but a seventh.

Cotton in eastern Asia. British capitalists built cotton mills in India. Indian capitalists built other mills like them. More and more of the cotton cloth needed in India was made in home factories. Less and less was imported from Great Britain, until now Indian cotton goods are shipped to the Straits Settlements, Ceylon, Aden, Persia, Iraq, and to Tanganyika, a large colony in east central Africa. This is cutting in on the British market. But even worse for Britain is the fact that Japan has developed a textile industry of her own and is now exporting large quantities of cotton cloth to China, India, Netherlands East Indies, and Cape Province.

Japan has recently sold silk goods in the United Kingdom and Italy. In fifteen

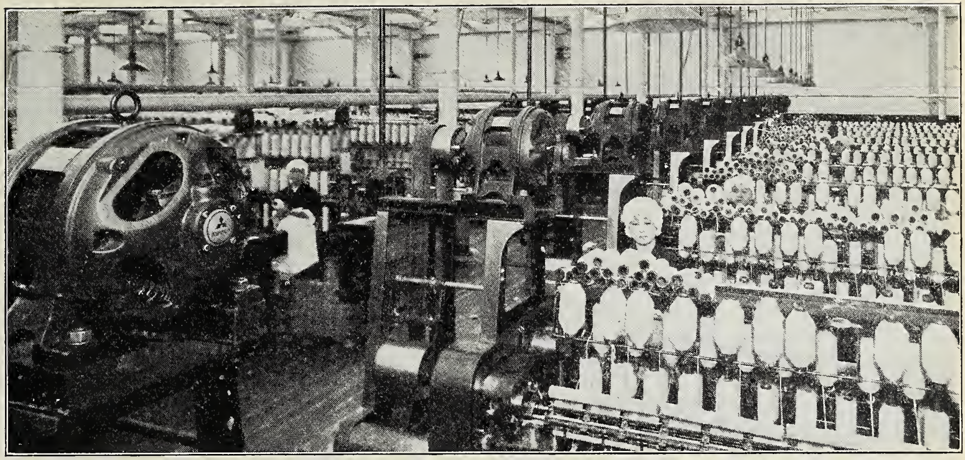


Fig. A. Spinning cotton in Japan—many spindles, one spinner. Compare with Figure 247-A.

years, 1913–28, Japan's production of silk and cotton textiles increased from 142 million to 588 million dollars and her exports from 36 to 226 million. Japan deliberately set out years ago to follow the example of England: to buy raw materials, to manufacture, to sell abroad, and to be able to buy food for her large and growing population. The competition of Japan and Great Britain will be one of the interesting things to watch.

A few modern cotton mills have been built in China. If China will stop her civil wars and settle down to work in the Western manner, Europe and America will sell her machinery and other goods much as they have sold these things to Japan.

The woolen industry. This industry does not differ from the cotton industry in any important principle. The woolen industry uses a different raw material; makes a warmer cloth used for men's suits and overcoats, women's warm dresses, blankets, carpets, and other heavy articles. Like the cotton industry, the wool industry takes a raw material, removes the impurities, grades the fibers, smooths them, spins the thread, weaves it, and puts it through the various processes necessary to make the raw material for the clothing manufacturer.

Like the cotton industry, the woolen industry moved from the home to the factory. England led the world in making woolen goods. The finest woolens used in the United States still come from Yorkshire, England, just over the ridge from Lancashire.

This industry also came to America, where most of the early factories were in New England and Philadelphia. The industry has not moved to the South. Its chief centers are still Lawrence, Lowell, and Worcester, Massachusetts; the vicinity of Providence, Rhode Island; Yonkers, New York; and Philadelphia.

Raw material for textiles. In the United States not enough wool is grown to supply our own needs. We usually import more than 200,000,000 pounds of wool yearly. We get fine wool for clothing from Australia and Argentina, coarse wools for carpet from the flocks of the Asiatic nomads and from the Highland flocks of Scotland.

Silk and rayon. The manufacture of silk cloth had its origin in China. China, Japan, and Italy now produce most of the world's raw silk. France and Spain produce lesser amounts. The silk mills of the city of Lyon, France, are not far distant from the silk growers of southern France. These mills have long been famous for their beautiful brocades.

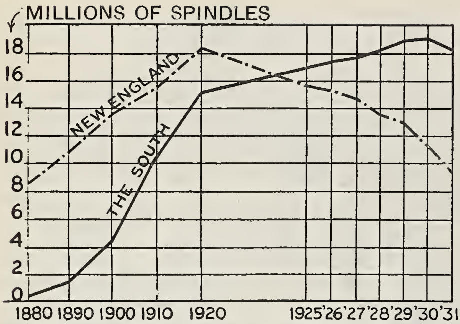


Fig. A. What does this graph tell about the textile industry in New England and in our Southern States?

People in the United States, being richer than those of any other nation, wear more silk than do the people of any other nation and import more silk than do all other nations combined. In some years silk, both raw and manufactured, is our chief import, most of it coming from Japan. Without the money derived from silk, Japan would be almost ruined.

The silk manufacturers built their mills near other industries that furnish occupation for men. Women and girls of the family work in the silk mills. Thus, Paterson, New Jersey, where there are many machine shops, has become the greatest silk manufacturing center of the United States. Paterson has 526 establishments, 13,000 workers and officials, and makes one ninth of the national output. Large silk mills are near the coal mines of Scranton and Wilkes-Barre, Pennsylvania, and the cement plants of Allentown and Easton, Pennsylvania.

Rayon manufacture. Rayon manufacture is, from the standpoint of business, merely another kind of silk manufacturing, the product costing less. Rayon is made as nearly as possible to look and wear like silk.

Knit goods. Women still knit by hand, but nearly all of the hundreds of millions of dollars' worth of hosiery and knitted underwear produced in the United States is made by machines which turn out the product with amazing speed, using cotton, silk, rayon, or wool according to the demands of the market. Knitting mills are scattered throughout the textile districts of New England, North Carolina, and Pennsylvania, and also through Tennessee, Wisconsin, and many other states. They are numerous also in the textile manufacturing countries of Europe, where the needs of the people are almost the same as are the needs of the American people.

THINGS TO DO AND THINK ABOUT

Map location game. Who is going to be caught? If you do not want to be caught, be able to locate every country or city mentioned in this unit. Choose a class leader and let him name some country mentioned and call upon someone to locate it. If the person called upon fails, one is taken from his score.

Some problems to figure. What do you learn about Great Britain's textile business by studying the table on page 362?

Finding reasons. Find reasons to prove the following statements:

1. Textile factories are spreading from country to country.
2. Japan's textile production has increased during the last twenty years.
3. The woolen industry resembles the cotton industry.
4. The United States does not supply sufficient wool for herself.
5. Rayon manufacturing is similar to silk manufacturing.

CHAPTER SUMMARY

New words or expressions. Use the following words or expressions in sentences referring to the text: textile, jute, asbestos, ramie, bleaching, spindle, hydroelectric plants, fibers.

Studying figures. How many striking things does Table 42, page 362, tell you? Can you give reasons for some of them?

The meaning of pictures. Examine the pictures in this chapter and tell what important thing or things each one shows.

A textile-center map. In this chapter have been mentioned many textile centers in the United States. Locate these centers on a map.

For your class museum. Bring small samples of various kinds of cloth to class. Make a display of these the same as you did of the minerals.

For extra credit. 1. Make special reports on:
(a) Hargreaves, Cartwright, or Arkwright.
(b) The spinning jenny, the flying shuttle, the cotton gin, or the sewing machine.

2. Choose one member of your class to report on ramie. Tell the findings that science has made so far and also its future possibilities.

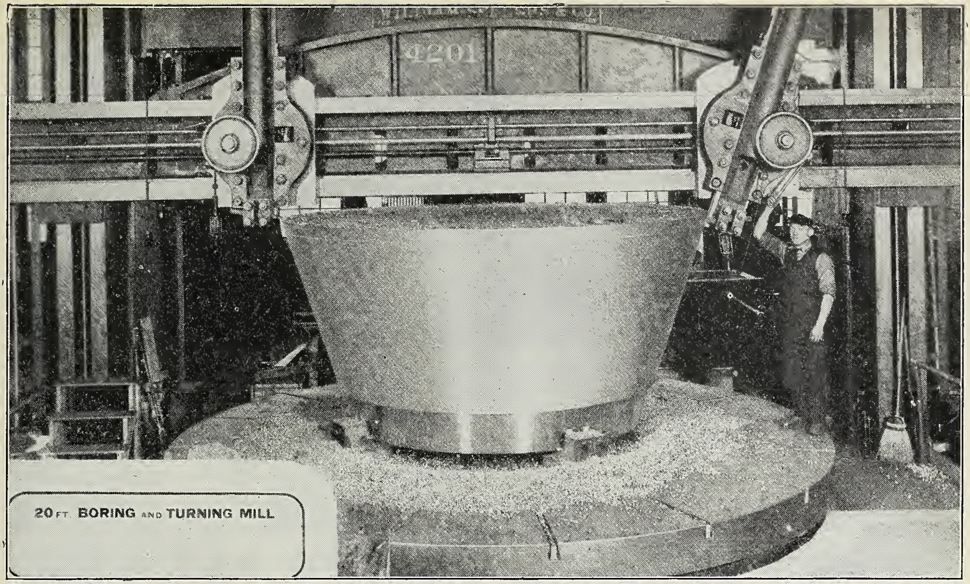


Fig. A. This machine is one of the tools that gives us machinery. The platform on which the man stands revolves, and pieces of metal, 20 feet in diameter, can be fastened to it, will revolve with it, and can be given smooth circular surfaces or have holes bored in them. Near the man's elbow is one of the two cutting tools now engaged in shaping the outside of the large piece of metal. The cutting tools move six feet vertically and ten feet horizontally. *Planers* and *lathes* work in much the same way.

CHAPTER XXVII

MACHINERY AND VEHICLES

UNIT 1—THE MACHINE TOOL AND THE AUTOMOBILE

Which Are They? What two things have done the most to change our manner of living since machines began to make machines? Explain.

How the neighborhood has been extended. Thirty years ago when a farmer wanted to take a short journey—say of twenty miles—he probably went in a vehicle drawn by a horse. To go and return required the best part of a day. Today, in his automobile, he may go the same distance in less than an hour. Thirty years ago the farmer knew few people more than fifteen miles from home. Now he knows people who live much farther away. His children used to go to a little one-room schoolhouse, where all grades were in one room. Nowadays the school bus carries the farmer's children several miles to the graded school and to the high school.

People now live ten, twenty, or thirty miles from a city and go in their own automobiles to the city to work. Many take trips and vacations in automobiles, going from town to town, from camp to camp, from coast to coast.

George Washington's coach. George Washington's coach was built by the coachmaker, one piece at a time. If a part broke, the coachmaker made a new piece and repaired the coach. Today, if a part in your automobile breaks, you go to the nearest agent who sells your make of car. He gets a duplicate part from a shelf in his stockroom, puts the part in place, and you are soon on your way again. This difference in process has made great changes in the manner of living in many parts of the world. The changes came because of

Fig. A. One of the great automobile plants near Detroit. Can you find the artificial harbor, the ore boat, ore pile, blast furnaces, the huge workshops, and the town beyond?

machine tools, which means machines that make machines.

The automobile. In an automobile factory (Fig. 254-A) we see a ladle of molten metal poured into a mold to make an engine block. When the metal cools, the block is put into a machine tool called a *planer* (Fig. 253-A), where engine power drives a sharp-cutting tool against it and smooths its surface. The block next goes to the boring machine, which bores holes in it to become the cylinders of the engine. Other machine tools, called *lathes*, take this or other pieces of metal and turn them against chisels to make a curved surface. A baseball bat is the result of lathe work. Still other machine tools, called *shapers*, cut grooves as desired. *Milling machines* cut grooves in the edge of a wheel and the wheel becomes a cogwheel. These five machine tools—lathes, planers, boring machines, milling machines, and shapers—make a piece of metal into almost any shape imaginable.

Increase in the number of automobiles. In 1896 there were four automobiles in the United States; in 1900, 8000; in 1910, 468,000; in 1920, 9,232,000; and in 1933, 24,317,000. This great increase has resulted because we have used *standardization, interchangeable parts*, and *mass production* in the making of most kinds of machinery, including automobiles.

Mass production. It may take half a day to set a machine tool (Fig. 253-A) to machine even a small piece. The tool, when set, may machine a small piece in five minutes. Over and over again, the machine can make similar pieces without being reset. If it is only to be used in making one kind of piece or even only one piece, the machine may be a very *simple* (inexpensive) one. The operator soon learns how to use such a machine, and can do the work very easily, quickly, and cheaply.

The assembly line. Different departments in the automobile factory make the different parts—steering wheels, engine, wheels, and other parts. In the final assembly a moving platform carries the automobile-in-the-making past a line of workmen, each of whom stands ready to put on his particular bolt or part with skill and speed. In a short time the whole machine, with each of its 5000 or more parts in place, is ready to run.

The advantages of mass production. Standardization and interchangeable parts, and their result, *mass production*, have made automobiles less costly. Where these methods are used, articles cost less than in a factory where fewer cars are made and where the machines must be frequently reset to make different required parts. Were it not for tariffs in foreign countries, there would be but few automobiles made anywhere except in the United States. More than 70 per cent of all the automobiles in Denmark come from the United States.

Some automobiles are made in United Kingdom, France, Belgium, Germany, and

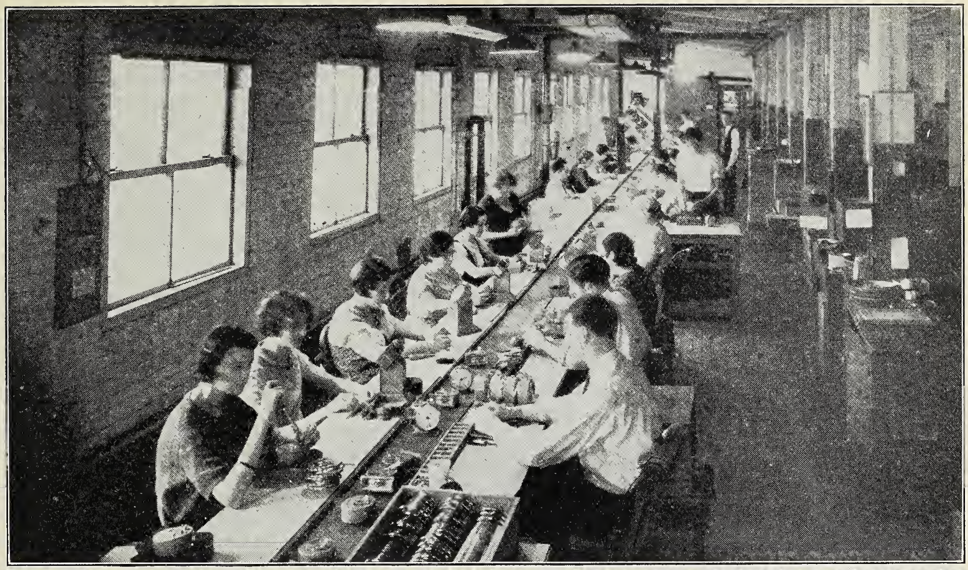


Fig. A. *Mass production.* The assembly line in a clock factory. Clocks move on the belt from worker to worker until the last person puts on the last piece of the finished clock. They need to make 6000 clocks a day to make it pay to use the belt. The belt saves 10 per cent of the cost of assembling. Automobile factories use the assembly line. It is one of the devices much used in mass production.

Italy, but in those countries high tariffs are levied against American machines. To avoid the tariffs, American companies ship motor parts to foreign countries. There they have assembly plants, and they also make automobiles in some foreign countries. But even so, a cheap British car costs about 50 per cent more than does a similar car in the United States. Because wages are lower in England than in the United States, it takes three or four times as many days' wages to buy a car there.

Where can automobiles be made? Brazil bought textile machines and now makes most of her own textiles; but not a single automobile is made in Brazil. The hundreds of parts needed for automobiles require many hundreds of processes. Even in the United States scores of factories must combine their produce to make an automobile. Does this help to show why automobiles are not made in South America, Africa, the most of Asia, Mexico, Central America, or the islands of the sea? The motor vehicle and other machines are the products of *highly industrialized countries.* In a recent year the United States, the United Kingdom, and Germany made 84.3 per cent of the world's machinery (United States 57.6 per cent; United Kingdom 13.6 per cent; Germany 13.1 per cent). Most of the remainder is made in France, Belgium, Italy, Switzerland, Czechoslovakia, and Sweden. A little is also made in Japan.

Where automobiles and trucks are made. The manufacture of automobiles and trucks is centralized in a few countries, more than three quarters being found in the United States. In this country the industry is centralized in a remarkable manner. Within a short period of time some scores of companies have been formed to manufacture automobiles, but only a few remain. Three companies now make nearly all the automobiles manufactured in the United States.

The hard wood of Ohio, Indiana, and the Lakes region was the chief material used for making carriages and wagons in 1900. Most of that industry was located between

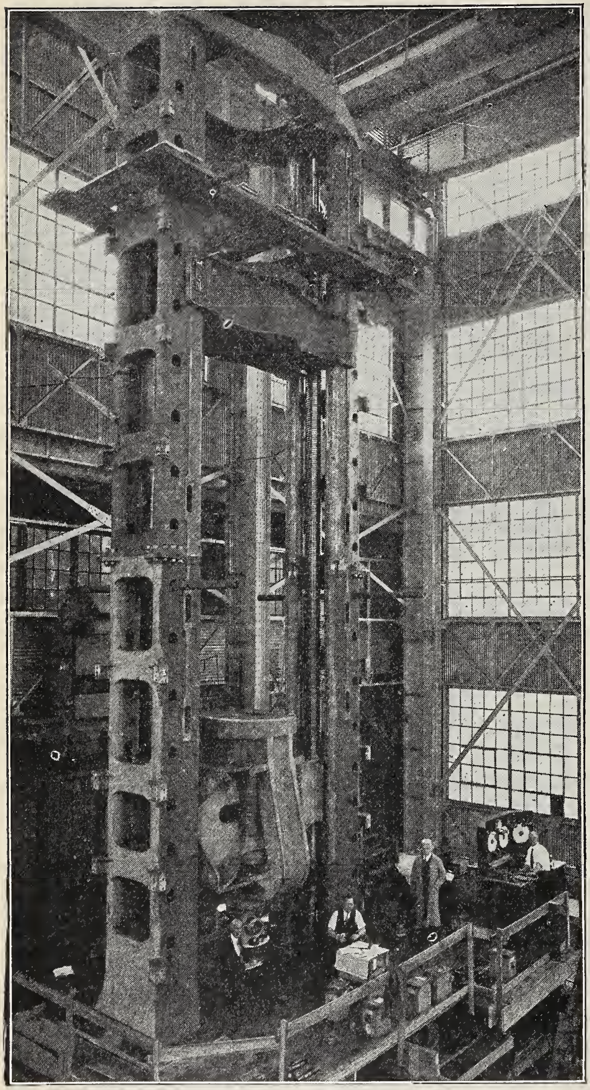


Fig. A. This testing machine in the University of California laboratory was built near Philadelphia. It can test a piece of material that is 33 feet long and give it four million pounds pressure in many different ways. Much study and investigation and testing of materials are necessary in designing new machinery.

Cleveland and Chicago, Indianapolis and Detroit.

The automobile was really a new kind of carriage. In fact, some carriage makers turned to making automobiles. The early success of Detroit manufacturers caused others to build plants in the Detroit area. The advantages were many. Wood from the Great Lakes forests was close at hand. The Great Lakes waterway was there to carry wood, coal, iron, iron ore, and steel. The Detroit area was near the center of population of the United States. It afforded good transportation by lake, by railroad, by truck, and by automobiles on their own wheels. The Detroit district has twenty-seven automobile plants, and seventy other plants making bodies and parts for automobiles. One half of the workers of the 1,500,000 people who live near Detroit have something to do with making automobiles. Michigan makes four times as many automobiles as Ohio, the second state. There are important manufacturing plants at Flint, Lansing, and Pontiac in Michigan; at Cleveland and Toledo in Ohio; at Indianapolis and South Bend, Indiana; and in Wisconsin.

THINGS TO DO AND QUESTIONS TO ANSWER

Words to use. Make a short talk to show that you really understand one of the following terms: lathe, planer, boring machine, standardization, interchangeable parts, mass production, assembly line, setting a machine, tariff.

Historic characters. Let the class divide into groups. Each group elects a spokesman who says: I am ——— (some historic character). In my day ———. Then let him tell what machinery he had and how it was made.

The automobile manufacturer. Tell about the advantages or disadvantages of starting an automobile plant in Brazil, Japan, Central America, Michigan.

A bit of arithmetic. A man receives fifty cents an hour. In two hours he sets a machine tool. In six minutes he machines one piece. What is the total labor cost for two pieces? for ten? a hundred?

UNIT 2—SOME OTHER IMPORTANT MACHINE INDUSTRIES

> Locating an Industry. Where should one build a new factory for making machinery?

Nearness to market. Which takes up more space: carloads of lumber, steel plates, steel rods, tin plate, glass, blocks of copper, lead, zinc, kegs of nails, boxes of bolts, cans of paint, as they go to a machinery factory, or the same materials made up into machinery and sent to market? The answer to that question shows why it is important for a factory that makes machinery to be near its market.

Look at the maps that show the production of corn (Fig. 87-A), wheat (Fig. 63-A), and swine (Fig. 105-B). Do they suggest reasons why Chicago and places within a hundred miles of it make about two thirds of all the tractors, reapers, harrows, corn planters, cultivators, and other farm machinery used in the United States?

Textile machinery. The textile industry in the Southern States is a new industry in that region. Textile machinery is not made there. No great amount of skill is required to *run* a textile machine, but it takes a great deal of skill to *make* a textile machine. That reason, combined with nearness to markets, explains the fact that in the textile-producing northeast part of our country, with its long-established manufactures, there are four centers for making textile machinery: Worcester, Massachusetts; the Providence-Fall River-New Bedford district; the Boston district; the Philadelphia district.

In Europe we see the same principles at work. A dozen textile towns in Lancashire around Manchester boast of the fact that they also manufacture textile machinery. Burnley, one of these towns, claims to make more looms than any other city. Bolton, not far away, where the firm of Dobson and Barlow was founded in 1790 by Mr. Dobson, was one of the first manufacturers of textile machinery anywhere in the world. These Lancashire textile-machine manufacturers equipped the textile mills of India, Japan, and Brazil with machinery. With the new machines those countries developed their own textile industries and no longer bought so much cloth. Thus Britain lost customers for cloth, and, as a result, her export textile industry was almost ruined.

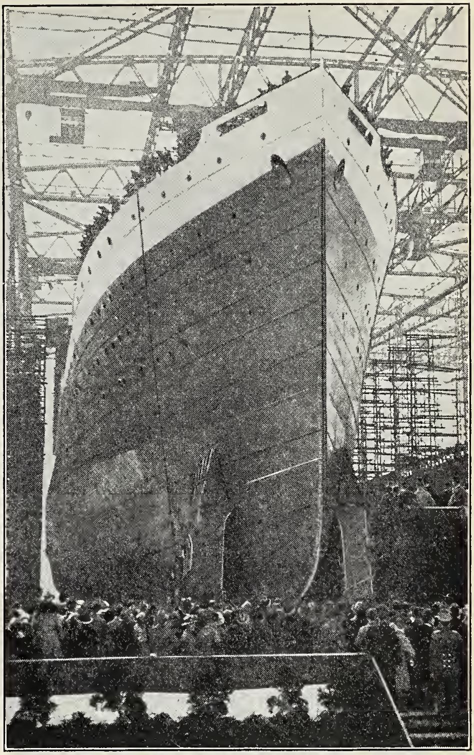


Fig. A. The ship is the largest thing that man has moved. He builds it on a sloping way and lets it slide into the water. The modern steel steamship is a great job of machinery building. The chief centers for shipbuilding are in the vicinity of New York, Philadelphia, Boston, Newport News, San Francisco, and Seattle. In Europe important centers are the rivers Clyde (Scotland) and Tyne (England), and the harbors of Hamburg and Bremen.

Yorkshire, the center of the British woolen-textile industry, is the center for the manufacture of machinery for woolen mills.

Electrical machinery and apparatus. Make a list of the different kinds of machines operated by electricity and you will see that the manufacture of electrical

machinery is one of the great industries of the United States. Because this type of machinery is used in almost every village and on many farms, there is an advantage in its being made near the center of population. This helps to explain why the Chicago district makes three times as much electric goods as the Philadelphia district, another important center. The Philadelphia district is followed by the industrial areas of New York, Pittsburgh, Cleveland, and southern New England.

Locomotives and airplanes. We have a quarter of a million miles of railway in the United States, but we have only sixteen locomotive plants. The reason that there are so few plants is because of mass production. The important centers are Eddystone, near Chester and Philadelphia in Pennsylvania, and the section from Schenectady to Albany in New York. Buffalo is important in the manufacture of airplanes.

Machine tools. Factories that make machines provide the market for machine tools. Therefore, they need a central location in our manufacturing region. The leading centers are Cincinnati, Cleveland, Worcester, Massachusetts, Hartford, Rochester, and Chicago.

Machine manufacturing in Europe. We see the same principles responsible for locating the machine-manufacturing industries in Europe. In Europe, as in the United States, machines are made near where they are used. Germany has three chief districts: the iron and steel district of the lower Rhine; Leipzig and neighboring towns in Saxony with their coal, iron, and textiles; and the city of Berlin.

The United Kingdom is suffering from the disadvantages of an early start. On each of her half dozen coal fields are many small towns with many small factories that did fine work in the old days from 1850 to 1880 before mass production was developed. Birmingham boasts the most varied machinery manufacturing industry to be found anywhere in the world. That very fact of variety is one of the things that is the matter with British foreign trade. They have *variety*. We have *specialization*.

Machinery in other countries. Five other countries have important machine manufactures. Switzerland specializes in making the most delicate of common machines—watches. She also makes fine machinery and many instruments of precision which, like watches, reflect great skill in making use of a small amount of raw material.

Sweden shows the same qualities of industry in an important export of balls and ball bearings, dairy machinery, and many other small but expensive machines.

Western Czechoslovakia (Bohemia) resembles Germany in its industrial development, and exports some machinery of fine quality.

Russia set out with a grand plan to make herself an industrial nation in five years by copying mass-production methods. She hopes to make tractors, automobiles, and many other articles in great quantities, and, because of this, is building huge factories.

Japan, having set out years ago to become like England, sent her sons to European and American technical schools to learn mechanics, engineering, and chemistry. Japan has bought Western machinery and is carefully copying it for her own use, and at the same time she is buying more machinery. Some day she may export machinery as she now exports cotton textiles (page 251).

THINGS TO DO AND THINK ABOUT

Market or materials? Tell what it is that makes a place a good place to manufacture machinery. Pick out as many examples as you can and explain each one.

Countries. Tell about the different character of the machine industry in several countries.

CHAPTER SUMMARY

Examine the pictures carefully. Tell first what *things* you see in the pictures of this chapter and then what the pictures tell you *about.*

Manufacturing. 1. Is machinery making the countries more or less independent of each other?

2. Suppose you are a Cuban, a Swiss, a Japanese, a Chinese, an Englishman, an American, a Brazilian. Make a little talk about "The machinery I should like to use."

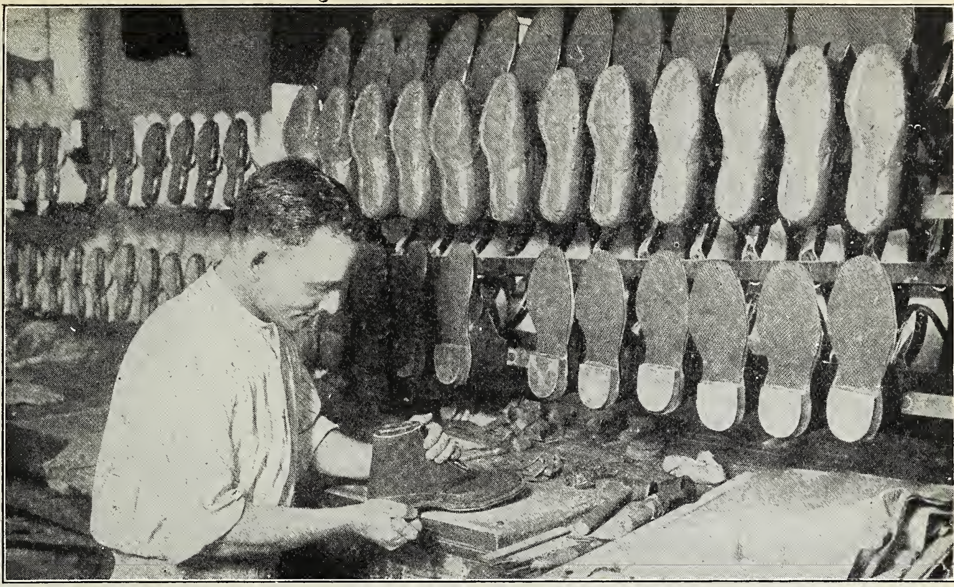


Fig. A. Arctics for snowy weather must have a heavy sole of rubber, rubber side stripping, and canvas uppers. The workman is seen in the picture smoothing down the rubber edging on a shoe.

CHAPTER XXVIII

RUBBER MANUFACTURES

TIRES AND OTHER RUBBER MANUFACTURES

PROVE OR DISPROVE. Use facts about rubber to prove or disprove this statement: "This is an age of scientific industry."

Newness of the rubber industry. Our grandfathers wore shoes and boots of leather. When it rained, their feet often got wet because it is now as then very difficult to make leather footwear waterproof. Before the Civil War a teamster in the United States frequently made a journey of two or three days to take a wagonload of grain to a canal, railroad, or city market. If the teamster pulled off wet boots at night, he probably was not able to get them on again in the morning. Therefore, he often slept in his boots on a tavern floor with his feet near the open fire.

Today we have rubber boots, rubber shoes, rubber soles, rubber clothes, rubber hats, and about 30,000 other articles made of rubber. Rubber received its great start in the discovery made by Charles Goodyear in 1839. He found that rubber melted with a little sulphur became tougher and could be used in many more ways than before.

For a long time rubber was used chiefly for footwear, hose, and belting for machines and for insulating material for wires. But suddenly the pneumatic tire came. Tires now take more than 80 per cent of our greatly increased rubber imports. The tire industry also uses many thousand bales of the finest long-staple cotton. Millions of dollars' worth of this cotton is imported from Egypt (Fig. 173-A).

Rubber tires. For a hundred years men experimented with tires for bicycles and steam carriages, but until the pneumatic tire was made, these were not popular. Motor vehicles that did not run on tracks were too rough riding for comfort. The pneumatic tire made the bicycle popular.

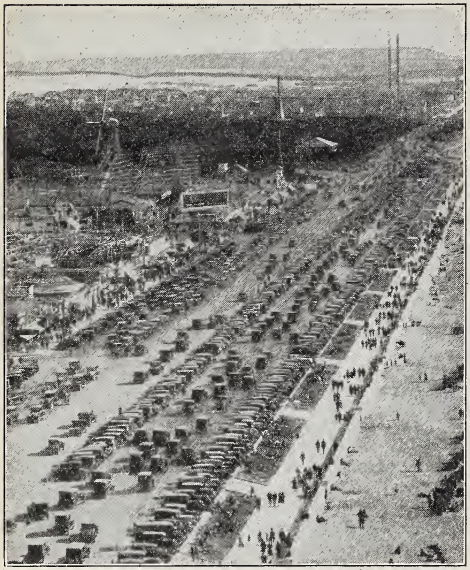


Fig. A. This drive along the ocean front at San Francisco accounts for some of the output of rubber tires at Akron, Ohio, and at Los Angeles.

In the 1890's the roads of America swarmed with bicycles, but it was not many years before the automobile replaced the bicycle.

Like the American automobile industry, our tire industry now towers above that of all other countries. In 1930 we made 51,000,000 tires; United Kingdom, 5,000,000; France, 3,000,000; Canada, 3,000,000; Germany, 2,000,000; Japan, 400,000. Some of these tires, though manufactured in those countries, are American made because American companies have branch plants in several foreign countries.

Akron tires. The manufacture of pneumatic tires began in the early rubber factories, situated chiefly in New England, New York, and New Jersey. Soon the tire moved west with its great master, the automobile. Today Akron is, eight or nine times over, the greatest rubber-manufacturing center in the world.

In 1932 there were enough tire factories in Akron to supply all the tires used in the whole world. Like the American automobile works, the huge tire plants cannot run full capacity for a whole year at a time, because the market cannot use all the tires that the factory can make.

Tire manufacturing is a large-scale industry. Akron, the great center, together with its industrial area, has but fourteen factories. These turned out $466,000,000 worth of tires and tubes in 1929. The state of Ohio has two thirds of the total product of the country. Other tire factories are scattered in a triangle between Detroit, St. Louis, and Minneapolis.

Los Angeles tires. In a short time Los Angeles has become the second largest world center for tires. Her position, beside her own harbor, enables Los Angeles to get rubber from Singapore for a lower freight rate than does Akron. The dense population of Los Angeles and vicinity furnishes a good labor supply. California has a large market for tires because in that state there is one automobile for every 2.8 persons—the national average is one automobile for 4.6 persons. Los Angeles is a more convenient place than is Akron from which to reach eleven Western States. Ships passing through the Panama Canal enable Los Angeles to compete with Akron in Eastern cities.

Most of the Los Angeles tire factories are branches of a few great companies which have plants at Akron, and many Akron plants were built as branches of companies which had started farther east. Many of these companies not only make tires but hundreds and even thousands of other rubber articles.

Rubber manufactures in Europe. The European countries, with their smaller output, make almost as varied a list of rubber products as we make. Their rubber goods, however, must be made on a smaller scale and often with a greater amount of labor for each unit of output. The chief British rubber industries are located in Liverpool, Manchester, and adjacent towns. In Germany the chief centers are Hannover and Berlin.

Russia, with her gigantic industrial plans, built a single rubber factory at Yaroslavl,

in the Ivanov industrial region. This is larger than any other factory in Europe and second only to one in the United States. This factory is expected to have an output of 6,500,000 tires a year, enough to supply Russia for the present. Another factory is planned to turn out 15,000 tons a year of cord products necessary in making rubber, and a third factory in the same locality is planned to make 75,000,000 pairs of rubber soles and heels. It remains to be seen how these gigantic plans will work. American engineers helped to build and start these big factories.

Rubber boots and shoes. There are but twenty-two factories in the entire United States for making the very useful rubber boots and shoes. Ten in Massachusetts make two fifths of the $100,000,000 worth produced. Four are in Connecticut and three in Rhode Island. No other state has more than one such factory. This branch of the rubber industry, unlike that of making tires, has not moved out of its original home in New England.

The manufacturing countries of Europe also make rubber footwear and compete with the United States in foreign markets. But the recent sensation in the rubber-shoe business has come from Japan, where people work for a much smaller daily wage than has been common in the United States. Making rubber shoes, especially the canvas shoe with rubber sole, is a very simple operation Thousands of Japanese families make canvas shoes in their homes. Some are made in large factories. Japan is near to the rubber supply and her mills furnish the necessary cotton material. A few years ago the United States, Canada, and United Kingdom exported rubber shoes to India, Siam, the Philippines, and Netherlands East Indies. Japan has now captured almost all of that trade and also that of South Africa and East Africa. The Japanese worker receives very low wages.

Fig. A. Probably you have had a pair of shoes or sneaks with crêpe-rubber soles. These native women of Sumatra are sorting and packing crêpe rubber for shipment. The "draperies" in the background are crêpe rubber.

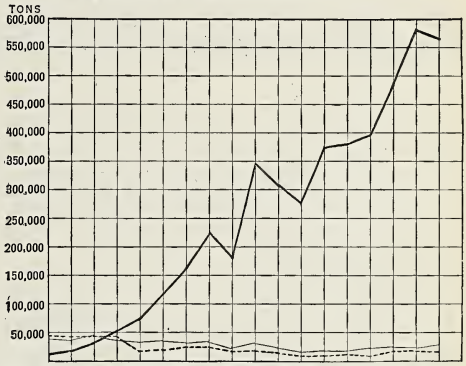


Fig. B. What does this graph show about the world production of rubber for a period of 18 years from 1910? From a *Commerce Yearbook* find figures to complete this graph.
Heavy line—Plantation-grown, mostly in the Far East.
Fine line—Grown in the Amazon Valley.
Dotted line—Grown in all other places.

CHAPTER SUMMARY

Graphs. If one tire represents France's production of tires in 1930, how many would equally represent Canada's production; that of other countries? Make a graph like that in Figure 261-B to show the amount of rubber imported by different countries (page 362). One like Figure 261-B to show total production of rubber.

Independence. Can a tire be "all American" or "all British" or "all French"?

The ideas. Give some ideas about Los Angeles, Russia, low wages, competition, inventions and industries, pneumatic tire, crude rubber, Amazon Valley, Sumatra.

For those who want to think. See if you can find the spot which represents the center of the population in the United States today. How far is it from Akron?

Fig. A. In Paraguay, South America, these long-horned oxen are hauling quebracho logs from the forest to a plant where tannin is extracted from the wood. Why do the carts have big wheels?

CHAPTER XXIX

LEATHER AND ITS MANUFACTURES

UNIT 1—SKINS, TANNING, AND LEATHER

> TRADE POLICY. Show the relationship of the tanning industry to the idea that a nation can live without trade.

An old industry. Skins were doubtless among the first things that man used for his clothes and shelter. At very early times in every continent men tanned, or made into leather, the skins of many animals. They treated the skins with certain vegetable substances that aided in removing the hair, flesh, and fat. The skins then became strong, pliable leather. By this means Eskimos, Indians, and other primitive peoples still make excellent leather.

Tanning leather. For a very long time men soaked the skins of animals in water to which was added a substance called *tannin*. The bark of the oak, hemlock, wattle, and some other trees contains tannin. Throughout the nineteenth century millions of oak and hemlock trees were cut down in American forests and stripped of their bark. Wagons loaded with the bark arrived at near-by tanyards. Other wagons loaded with hides were to be seen in many a rugged mountain valley, creaking along the rough roads to tanyards. In the tanyard two or three men soaked the hides with water and powdered bark or with the powdered leaves of the sumac bush.

At that time the largest tanning industries sought locations near the forests of Appalachia and of the Great Lakes where *bark* could be had. A tannin famine threatened, but luckily someone discovered that good leather could be made with tannin derived from the wood of the quebracho tree which grows in the Gran Chaco of Argentina and Paraguay. Today 90 per cent of American *sole leather* is tanned with quebracho; only 7 per cent with oak, and oak combined with quebracho; and 3 per cent by the chemical method.

Leathers, other than sole leathers, may be tanned by the use of chemicals. Important among these are compounds of

chromium, sulphur, iron, aluminum, with soda and acids. The discovery of this fact brought a blessed release from the demand upon the forests and enabled the tanning industry to be moved near seaports, where imported hides, imported quebracho, and imported chemicals could be used nearer to centers of population and to the shoe factories.

Chemical tanning was invented in Philadelphia, and today Philadelphia and eastern Massachusetts are the greatest tanning centers in the world.

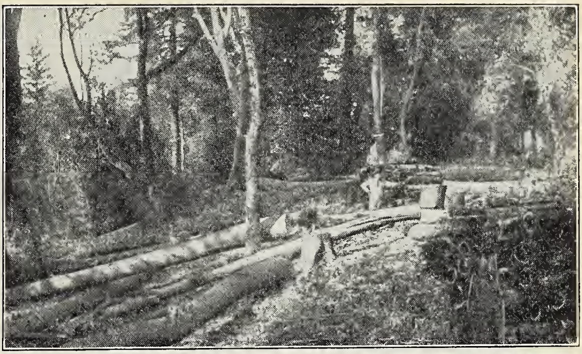


Fig. A. Tanbark and stripped logs in a California forest. Millions of logs have been stripped like that in the United States and then left to rot.

The source of raw hides and skins. We use the skins of all the domestic animals and of seals, walruses, kangaroos, whales, sharks, alligators, and snakes. The recent style of using snakeskin in making shoes caused an unusual demand for python skins in Siam. The resulting scarcity of pythons permitted the rats (the python's chief food) to increase so badly that the farmers petitioned the government to let the pythons live. Now several countries have closed season for python.

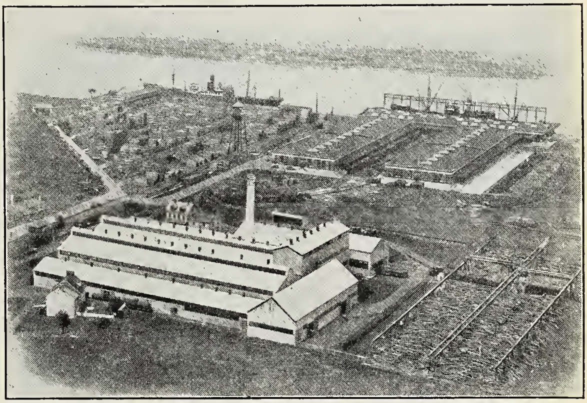


Fig. B. A great plant at Wilmington, Delaware, for the manufacture of quebracho extract. The logs, which you see in the yard beside the mill, were imported from Argentina in shiploads.

Not only do we use the skins of many of our own animals but we use skins and hides from most parts of the world—horse and colt skins from France and Argentina; cattle hides from Argentina, Germany, France, and Canada; calf skins from western Europe and Canada; millions of sheep skins from the Southern Hemisphere, the United Kingdom, and Spain; and, most numerous of all, goat skins from India, China, Mexico, and Brazil.

Leather in many lands. The leather industry, having come down from the ages, is to be found in almost every country. We have many kinds of leather resulting from many blends of tanning materials, from different processes of tanning, and from varying skills of tanners. Therefore, much leather passes from country to country. The United States imports millions of dollars' worth of raw hides and skins. At the same time we export millions of dollars' worth of leather.

There are important tanning industries in all western European countries, United Kingdom and Germany leading. The United States has had the great advantage over other countries of having native forests to furnish the bark. Most of the newer chemical processes for tanning leather were discovered and patented in America. For these reasons, several countries of eastern Europe send skins and rawhides to our tanneries and then get leather from us.

The United States is the largest leather

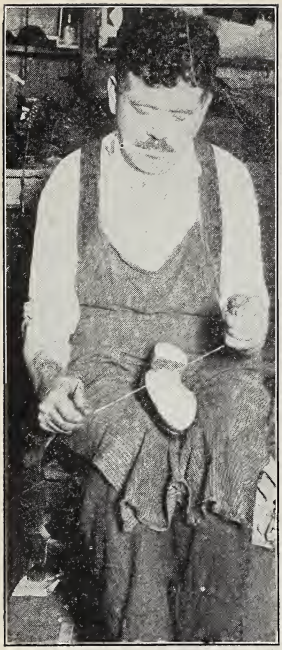
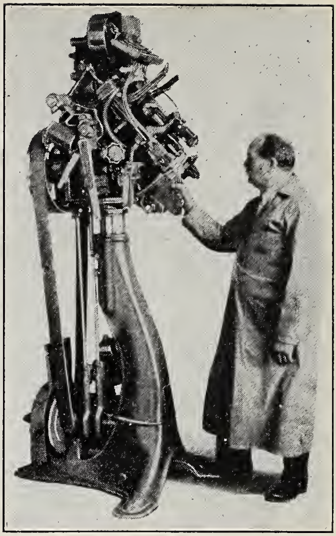


Fig. A. It took good work for the cobbler to make one pair of shoes a day, sitting on his bench and using a handful of simple tools. And it took him years to learn his trade.

Fig. B. This machine, the Rex pulling-over machine, grasps the upper with three pairs of pincher fingers, and then, as the operator touches levers, it pulls and pushes until the upper is in just the right place on the last. Then "click," and in go seven nails to hold it there. It took very skilful handwork to do this job by hand and it took years of experimentation to devise this machine. It has 1295 parts and it cost a million dollars to make the machinery to make it. It saves for the shoe manufacturers four times that much labor cost each year. ¶ There are more than 200 processes in making a good welt shoe. One well-known company uses 120 machines in making a single shoe. Each worker averages 12 pairs a day—*mass production.*



manufacturer in the world, the largest leather exporter, and finally we import about as much as we export.

Imitation leather. The research laboratories of many American manufacturing companies have discovered how to treat various fabrics so that they look and wear much like leather. As a result, many uses once served by leather are now supplied almost entirely with imitation leather—interiors of automobiles, chair seats, belts, coats, bags, sometimes even shoes.

THINGS TO DO AND QUESTIONS TO ANSWER

Facts you understand. Reread this unit of work; then write something about each of the following: tanning, hair, bark, quebracho, sumac, chemicals, Philadelphia, python, Eskimo, skins, exporter, importer, imitation leather, Paraguay, goat.

The problem of interdependence. For what articles mentioned in this unit does the United States depend upon her neighbors to supply her? If these imports stopped, what would we do?

Conversations. Pretend that some old trees could talk to each other by wireless. Let them have some conversations about things which they have seen.

Locations. Tell about the location of tanneries.

UNIT 2—MANUFACTURES OF LEATHER

THE COURSE OF INDUSTRY. Show how the shoe industry illustrates the development of manufactures.

Uses of leather. The chief uses for leather are shoes, harness, belting for machinery, traveling bags, trunks, upholstery, purses, and gloves. The 316 million pairs of shoes made (1930) in the United States required about 85 per cent of our leather. Nearly two thirds of the gloves are made in New York State, chiefly in the towns of Johnstown and Gloversville, which were settled long ago by Scotch glove makers.

Shoes, a stable industry. The demand for shoes is one of the most constant demands in all industry. Hard times affect the shoemaker far less than they affect the clothing or automobile manufacturer. Therefore the shoe industry may be called a stable industry.

Early shoemaking. Shoemaking probably began when someone long ago bound the skin of an animal around his foot as protection from thorns and stones. The shoemaking industry was an established trade when the Egyptians built the first pyramid.

During the time of George Washington it was customary for the shoemaker to measure the foot of his customer and to make a pair of shoes according to those measurements. In that period, shoemakers seldom made shoes for persons whom they had not seen. Later the New England peddlers, peddling brass and iron ware in winter, took with them a few pairs of shoes, hoping to find someone whom the shoes might fit. So it came about that, in settlements here and there in Massachusetts, a few men made shoes for a living and sold them to peddlers in the autumn.

Standardization and machinery. Shoes are now made in factories, by means of very complicated machinery (Fig. 264-B). One person makes one part, and another person makes another part, until, finally, scores of people sometimes work to make a single shoe, but each may average a dozen pairs a day.

Factory shoes are now standardized—made in almost all possible combinations of length and width. The salesman has only to measure your foot and then find on his shelves the shoe with those measurements.

Important centers of manufacture. The factory shoe industry got its start in Massachusetts. That state, with the near-by parts of New Hampshire and Maine, still leads the country in shoe manufacture. In Brockton and Haverhill, Massachusetts, there are dozens of factories that turn out shoes or even parts of shoes. Some factories make only welts, or insoles, or heels, or other parts, very much as different factories make the different parts of automobiles. The sales rooms for most of the New England shoe factories are in Boston. Only a short time ago someone counted 300 different shoe concerns within a few blocks, but the factories supplying the goods were scattered over a territory within a hundred miles of the city.

Many shoes are made in New York City, many in Binghamton, New York. St. Louis is the greatest single shoe-manufacturing center outside of New England and New

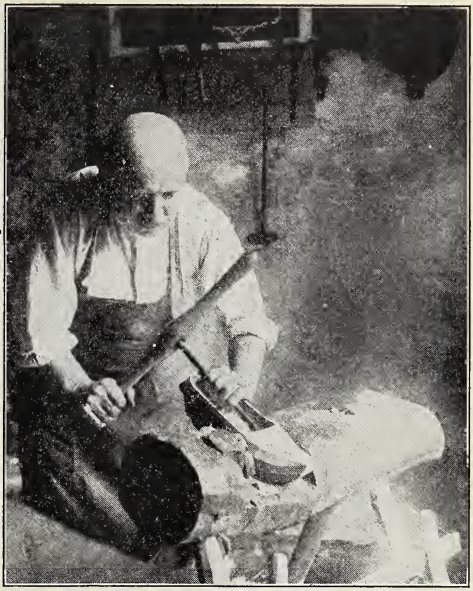


Fig. A. This Frenchman, making a sabot or wooden shoe, shows how millions of people reduce the demand for leather.

York. Railroads that come to St. Louis make the city a natural distributing center for a large area. People from St. Louis went to Massachusetts, bought shoe machinery, hired expert shoemakers at high wages, took the workers to St. Louis to teach the people the art of making shoes. Chicago, with the near-by parts of Wisconsin, is also an important shoe-manufacturing region.

Our foreign trade in shoes and shoe machinery. Machinery for making shoes was invented in America. The machine-made shoe is a better-looking shoe than the usual handmade shoe. Therefore American shoes became quite the style in foreign markets. We exported the new machine-made shoes far and wide, and there was once much talk about our capturing the shoe trade of the world. But besides exporting *shoes* we also exported *shoe machinery.* Soon, in many countries, the people were making shoes on machinery of American make or design. New Zealand, for example, bought fewer shoes from us in 1932 than

Fig. A. A shoe factory in far-off Tasmania.

she bought in 1902. She bought from Canada and United Kingdom instead. We export less than 1 per cent of the shoes we make. Canada is our best customer.

Shoes in foreign lands. Europe is rapidly copying the American shoe industry and uses American shoemaking machinery and mass production (Fig. 266-B).

Most of the people of China still wear the shoe with a cloth top and a sole made of many layers of felt sewed together—one of many tasks for the Chinese housewife.

There are a few shoe factories in Japan that manufacture shoes of American style, but most of the Japanese people still wear wooden sandals like those worn by their grandfathers.

THINGS TO DO AND QUESTIONS TO ANSWER

Three whys. 1. Why can the shoe industry be called a stable industry?

2. Why did the American shoe become the style in foreign markets?

3. Why did the United States not capture the shoe trade of the world?

Something to talk about. 1. Is the making of shoes by machinery better than the old system of making shoes by hand?

2. Materials from which shoes are made.

3. Centers of shoe manufacturing.

CHAPTER SUMMARY

New industries for old. 1. The harness industry used to be one of the leading leather industries. Modern changes have almost ruined it. Can you tell why?

2. Study carefully the pictures in this chapter and tell what they show about industry.

3. Tell a story about revolutions in tanning; in shoemaking.

4. Tell something about shoemaking and use the words *division of labor*.

Shoes throughout the world. Collect pictures showing the various kinds of shoes that are used in various parts of the world.

For library work and report:

The quebracho tree of Argentina and Paraguay.

The walrus, kangaroo, shark, and python.

Early methods of tanning.

Fig. B. The Batá shoe factory in Czechoslovakia shows how industry spreads. The man who built this great works studied American methods, uses American shoe machinery, and makes shoes in a *mass-production* way. In the foreground are houses for the workers.

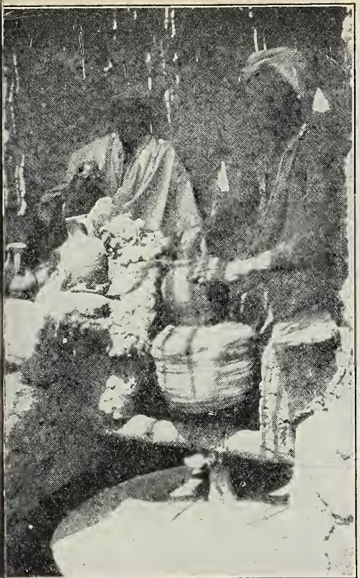


Fig. A (left). Egyptian potter at his wheel making a water jar in his mud-walled hut. He holds his hands against the clay and the turning of the mass gives it shape.

Fig. B (above). These Italian women are making brick by hand, a method thousands of years old. Explain their work.

CHAPTER XXX

ARTICLES OF CLAY AND GLASS SAND

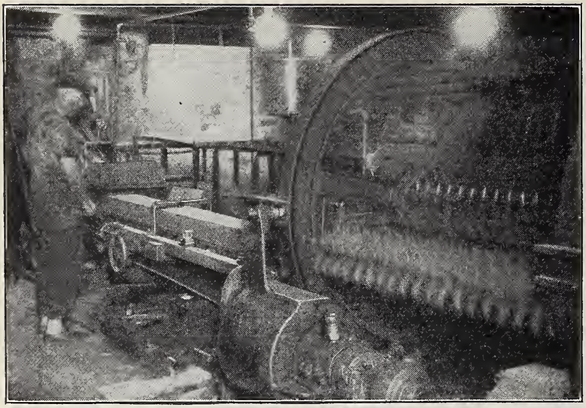
UNIT 1—THE LOWLY BRICK

To Fit the Circumstances. Can you find relationships between weather and suitability of material for houses?

A simple manufacture. One of the simplest forms of manufacture is that of making bricks. Clay and water are mixed together and pressed into a wooden mold shaped like a brick. The molded clay is then laid in the sun to dry. These sun-dried bricks, together with more mud, are used for making the walls of houses. Such a house will last a long time in countries where there is little frost. A building of sun-dried bricks needs a dry foundation and overhanging eaves to keep the rain from beating against the wall.

A simple type of building. It is an even simpler task to make a house of mud than of sun-dried brick. In Persia I once watched a man at work building such a house. He threw a few buckets of water on some earth. With a shovel he worked the mud to the right degree of stiffness. He then put the mud by shovelfuls upon the wall of the house he was making. He patted the mud with his hands until he made a layer about eight inches in height. After allowing this to dry, he put on a second layer and allowed that to dry. I was told that he worked in this way for three weeks, until the wall was six feet in height. Across the top of the wall he placed poles and on the poles he laid branches of trees. The house builder then laid a thick layer of mud on the branches. The mud house then had a good roof. Millions of people in the warm, dry parts of Asia, Africa, and America live in houses whose walls are of mud. Such a house is warm in winter and cool in summer.

I saw flood water two feet deep from the Tigris River flow into a village of mud houses. In a few hours they melted down like snow. A friend wrote me from China that they had had very heavy rains and



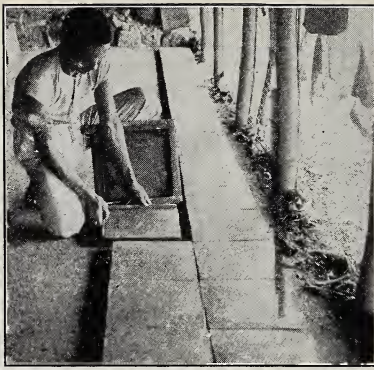


Fig. B. Molding bricks by hand to dry in the sun, Philippine Islands.

Fig. A. Mass production of bricks. The man is looking at the ribbon (square) of mixed clay as it darts out of the whirling brick machine that makes 10,000 to 12,000 bricks an hour. One man at the mixing mill, one at the brick machine, and seven to lift the bricks off the moving belt after the ribbon of clay has been cut into brickbats. How many bricks is this per man-hour? Compare Figures 267-B and 268-B.

that most of the people of the village were very busy rebuilding their houses.

The burned brick. When sun-dried brick is burned, it makes a very durable building material. For many centuries burning bricks was a village industry everywhere in Europe and America. In colonial America the farmer wishing to build a house would sometimes mold his own bricks from a near-by clay bank, cutting trees for fuel with which to burn the bricks.

Brick made with machines. Today we dig clay with a steam shovel. We mix it in a powerful machine which spurts out clay by the mile and then cuts it off for bricks. The thousands of bricks that are made in a day are burned (dried) in kilns heated by coal or gas. Since clay is widespread and transport is costly, brick factories are usually found near large cities in both Europe and America.

Recently, brick walls have had new competition from the concrete walls and from walls built of concrete blocks—sand and gravel held together by cement.

DO SOME THINKING

Use the following expressions in connection with things mentioned in this unit: hand industry, mass production, overhanging eaves, sun-dried, burned, mud walls, coal, wood, flood water two feet deep, cost per pound, railroad freight rate, industry in many places.

UNIT 2—EARLY INDUSTRIES AND ARTS

Problems. What uses for manufactures of clay can you find in your neighborhood? What would happen if we did not use clay?

A camp fire as a teacher. As you know, a camp fire will bake the earth beneath the fire. This fact may have started new ideas in the mind of some primitive man or woman sitting beside a camp fire long, long ago. Perhaps he (or she) took a lump of clay and played with it and shaped it to form a bowl or dish and then put it in the fire. When burned, this rude pottery dish held water or food.

The ancient industry of making vessels of earthenware began, not in one place or with one people, but in many parts of the world. Today there are remains of pottery from many lands and from many ages, even from many peoples whose races have disappeared from the earth.

We find decorated earthenware in the oldest graves.

The importance of pottery. To those farmers of the long ago who built mud villages on the banks of the Nile, the Euphrates, and the Indus, and at the foot of the mountains in Central Asia, pottery was a very important industry indeed. In the cool of

Fig. A. American cliff dwellers' pottery several hundred years old—built up without the aid of a turning wheel.

the morning and evening, villagers to this day walk down to the river or to the wells carrying large earthen jars. They fill the jars with water and carry them back to their homes for the day's supply. The people eat cereal and goat's milk from earthenware bowls. They store their breadstuff in earthenware jars as large as barrels. The hard earthenware protects the year's supply of grain from that bothersome hanger-on, the rat.

Long before Greece and Rome became great, the Mediterranean farmer stored his year's supply of olive oil in earthenware jars. The village (Pueblo) Indians of the arid American Southwest (irrigation farmers) still preserve their food and water in large earthenware jars. Many of these jars have beauty and grace. Some of them we are pleased to buy as ornaments for our homes (Fig. 269-A). We also make copies of Egyptian jars which, because of their beauty, are used to ornament the lawns and porches of many American homes.

Fig. B. Egyptian vase several thousand years old.

The village potter. During the long centuries that Europe was in the domestic era and during the American colonial period, the village potter, with his wheel (Fig. 267-A), was an important local artisan. He, with the blacksmith, the wagon maker, the tanner, the shoemaker, and the cabinetmaker made the local neighborhood nearly self-sufficient. The village potteries of Europe and eastern United States made pitchers for holding drink, crocks for milk and butter, and jars for pickles and preserves. The village potters made other useful articles, including the popular pie plate.

The artisan family industry. In China and Japan, the domestic system of living and making things reached its fullest development. Conditions in those countries have remained almost unchanged for the last few thousand years. The family remained together and often developed a family business enterprise, very frequently keeping their discoveries or inventions secret. Japan has diligently copied Western machine industry, but she has to this day families that have been famous for several centuries for making unusually fine lacquer and other beautiful wares. China has many such families. Sometimes a family dies out, and arts and crafts for which the family was famous disappear.

China has lost many arts. For many generations only the emperor's family could use tile of a certain yellow color for roofs;

Fig. A. Painting china in a Bavarian (Germany) porcelain works. Such a picture might be taken in Austria, Czechoslovakia, France, Belgium, or England.

its use was forbidden to all except the imperial family. Sixty or seventy years ago, the emperors became poor and weak and built no more buildings. Thus, tile of the imperial yellow color was not needed. When the emperors were gone and China became a republic, some new roofs of imperial yellow were wanted in Peiping (Peking), but no such tile could be found. Finally, an old man remembered that this tile had come from a certain village. In that village was found one man eighty-six years of age and another ninety-three, both of whom had made yellow tile when they were young. The two old men taught their grandsons the art, and once again imperial yellow tile can be had.

Japanese ware. The Japanese have long made beautiful porcelain, just as the Chinese have, but lately they have begun to manufacture by the machine system.

Making a program. Use this unit in making a program for class presentation. In addition to the talks, exhibits of pictures and articles will be interesting.

Three great potters. What does your library tell you about the following men? Bernard Palissy, John Frederick Böttger, and Josiah Wedgwood?

UNIT 3—CLAY PRODUCTS IN THE AGE OF MACHINERY

SIMPLE OR COMPLEX. Are we becoming more dependent or less dependent upon clay as the machine age advances?

Varieties of clay and its products. In the United States we have clay of many varieties and qualities. Clay suitable for making common products is widespread. Clay is dug and manufactured in every American state and in almost every foreign country. People who still live as primitive man lived make clay products by hand, but in America we use machines for most of the work in many of the clay industries. Machines are now used to make clay into sewer pipe and pipe for draining farm lands. These cheap, heavy, brittle articles made of clay are usually made near where they are to be used. Therefore the industry is found in many parts of the country, as is the cement industry. Other factories make fire brick—brick that will not melt in the heat when used as a lining for furnaces.

For the finer clay products there are factories that turn out hundreds of different pieces to be used by the electrician and the plumber. At Trenton, New Jersey, at East Liverpool, Ohio, and at other places there are dozens of plants making dishes to supply our kitchens and dinner tables. At San Francisco, Chicago, New York, Red Wing, Minnesota, and other places we see the work of men who combine art with business and have established factories that may truly be said to produce art goods—dishes, vases, tiles for floors and walls, and many other articles.

Alfred University, New York, has a school to teach ceramics, the art of making wares of clay.

The kaolin trade. Kaolin, the kind of clay used for chinaware and porcelain, is rather rare in its pure form. Kaolin has a variety of other uses, and tens of thousands of tons of it are shipped from Georgia, South Carolina, and Florida to other states. The United States imports nearly a quarter

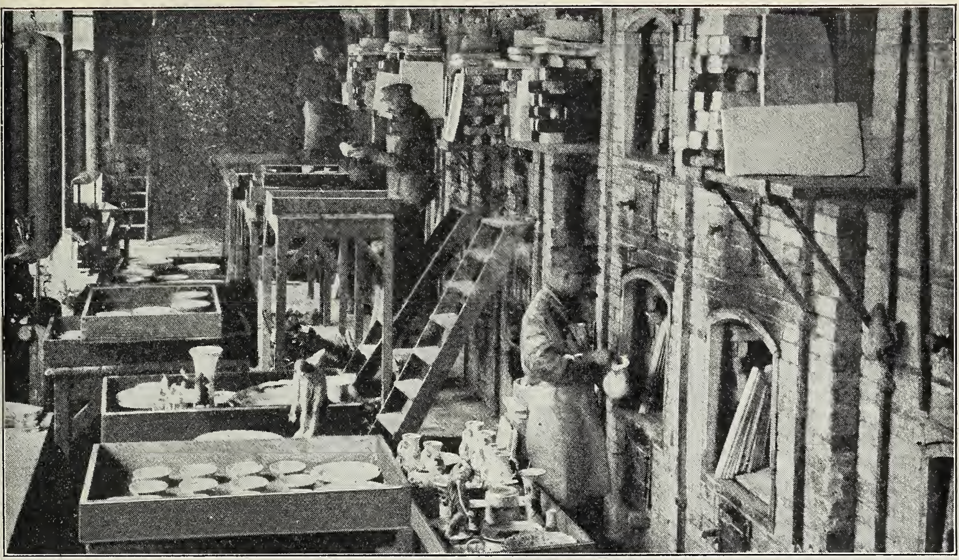


Fig. A. At the right of the picture are ovens in which the porcelain, which has been painted and glazed, will be placed for baking. This factory is in Bavaria, Germany.

of a million tons a year from the United Kingdom. The United Kingdom exports it to at least fourteen countries; Czechoslovakia to eleven.

Porcelain and the European worker. Europe makes an even greater variety of earthenware products than we make in the United States. Europeans use clay not only for articles in common use, but also for highly decorative and beautiful objects. In Europe a greater number of people work for low wages than in America. Many artists and skilled workers assist in making famous manufactured goods in porcelain and glass.

The famous potteries of Staffordshire are in a coal-mining district of central England, a district associated with smoke, dirt, dust, and ugly villages, as well as with clay products.

Beautiful porcelain that bears the trade name of Wedgwood, the name of the founder of the industry, is one of Britain's choicest products.

In France the name of Haviland and the city of Limoges are famed for beautiful china of very fine quality. In Holland a celebrated porcelain delftware takes its name from the city of Delft. Germany, Austria, and Czechoslovakia also manufacture and export fine products in porcelain, pottery, and glass.

Unexpected uses for clay. Thousands of tons of clay are used each year in paper mills. The clay is forced between the wood fibers and helps to make the paper smooth. Clay is also used for coating paper, in making oilcloth, as a filler in paint, and in the rubber factory. Clay is even used in making matches.

THINGS TO DO AND QUESTIONS TO ANSWER

Classifying. Divide clay products into classes. Write a definition of each class of products, and then under each class write as many examples as you can.

Some why's, where's, and what's. 1. What inconvenience would result in your neighborhood if all clay products were suddenly broken?

2. What is kaolin? Where is it secured?

3. Why is the manufacturing of clay products a widespread industry?

4. Where is Wedgwood ware made?

5. What city in France is famous for its beautiful china?

6. Where is delftware made?

Fig. A. This bit of Czechoslovakian cut glass gives us a peep at the art work of Europe.

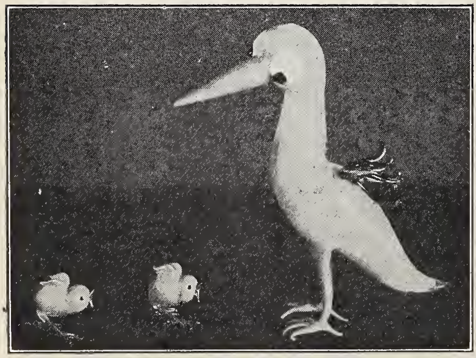


Fig. B. Here we see the skill and humor of the Czechoslovakian glass maker.

UNIT 4—GLASS

CHANGING TIMES. Tell about the glass industry as an old glass blower might see it.

The glass blower. For centuries the glass blower (Fig. 273-A), with his almost marvelous skill, made all our hollow glassware. Sand is the raw material used in the glass industry. Sand melts easily. Certain very pure sands are called *glass sands*. Mixed with various substances to give color and to make it melt more easily, glass sand is heated and becomes a liquid glass which is sticky like thick sirup.

Today, gas-fed flames keep furnaces of molten glass continuously hot. The glass flows steadily into machines (Fig. 273-B). Bottles and glassware are now cheap, and the glass blower is no longer an important artisan. Nevertheless, he still makes a few specially shaped articles.

The shifting American glass industry. Before railroads had opened up our country, southern New Jersey was a leading glass-making center of the United States. One of the towns was named Glassboro. The glass industry developed here mainly because there was plenty of sand and because near-by pine forests provided fuel.

Schooners sailing down the tidal creeks to Delaware Bay carried the glass up and down the Atlantic coast and rivers. After coal was available, some glass factories developed in the coal areas. But natural gas is the best of all fuels for glass making, so much of the industry moved to the natural gas belt of the Ohio Valley—Pittsburgh, West Virginia, Indiana, and on to Oklahoma.

Glass in Europe. The United Kingdom, France, Germany, and Czechoslovakia have important glass industries. Plate glass is an important export of Belgium.

Art glass. Glass not only serves numberless common uses, but is also the material used for making objects of art. Glass beads and other art glass have long been made in Venezia. Czechoslovakia makes

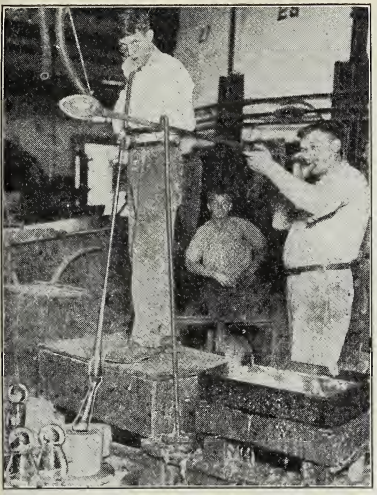


Fig. A. The glass blower got a lump of sticky molten glass on a long tube and blew it up almost exactly as we blow soap bubbles. It was very skilful work, but see Figure B.

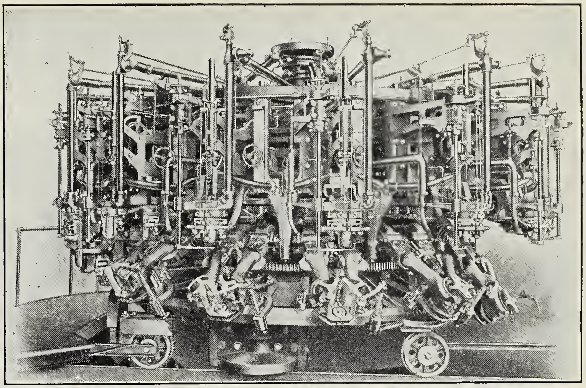


Fig. B. Mass production of glassware. In making bottles the glass blower has been replaced by this machine which receives a vat of molten glass, hands out hundreds of bottles each hour, and works night and day without ceasing, while a belt conveyor carries the bottles away.

the Christmas-tree balls for all the world. Cut glass, in which the artisan holds a glass vessel against a grinding stone and cuts figures on it, is made in many European and American cities.

Scientific glass. The lenses of a pair of spectacles are the product of a fine piece of work, but the lens of a microscope or a telescope is a much more accurate piece of work. Lenses are made at Pittsburgh, at Corning and Rochester, New York, in France and Germany. The German lenses are the most famous in the world. The great German optical works bearing the name of Zeiss, sends field glasses, microscopes, and camera lenses to almost every country.

Fig. C. Christmas-tree balls for Santa Claus from Czechoslovakia.

REVIEW

Do you know? 1. Why glass blowers are becoming a curiosity?

2. Why the glass industry has moved from place to place?

Extra credit. Find out about the activities and organization of the Zeiss Works at Jena, Germany.

CHAPTER SUMMARY

Picture study. Examine the pictures in this chapter and tell the importance of each picture in explaining the chapter.

Use the following terms. In connection with things in this chapter, use each term in a sentence: art, utility, less skill, more product, ceramics, learning, electricity, plumbing, foreign trade, cut glass, unexpected uses, kaolin, lens, Christmas trees, Zeiss, glass sand.

Your neighborhood. How many different kinds of brick can you find used in the various buildings of your neighborhood?

Fig. A. About 1789, the salt springs near Syracuse, New York, long known to the Indians, became known to the white settlers, who began the manufacture of salt. The brine came from a mass of solid salt which underlies the neighborhood of the city. Now the brine is brought in pipes from the salt beds and limestone is brought from near-by quarries to the great Solvay Process plant, shown in the picture, where they are used in the making of soda, ammonia, and coal-tar products.

CHAPTER XXXI

THE CHEMICAL INDUSTRIES

CHEMISTRY AND INDUSTRY

A Key Industry. Show in as many ways as possible how modern industry depends upon the chemical laboratory.

Chemical action. Ask your teacher to do this experiment. Buy five or ten cents' worth of silver nitrate at a drug store. Dissolve it in a glass one quarter full of water. Do the same with sodium chloride (common salt). Pour from one glass into the other. You will see a chemical reaction—a change in the nature of the substances. The silver of the silver nitrate unites with the chloride of the sodium chloride to make a third substance called silver chloride, a whitish substance which settles in the glass.

You can see another chemical action by lighting a match. This starts the oxygen of the air uniting with the carbon of the wood. That part of the matchstick that is not carbon remains as ashes. Air, water, clothes, your own body—everything, in fact—has chemical content and has been through chemical reactions.

The chemist studies substances and observes how they act upon one another. He learns to put two substances together to get a third substance, or to separate one substance into its many elements. Most marvelous of all, the chemist, having discovered chemical laws, can make new substances that Nature has not made.

The newness of chemistry. Chemis-

try is a very young science. Thousands of men in many laboratories in many countries are now constantly studying chemistry. New discoveries are made every month, and some of these discoveries make it possible for us to have new industries or to carry on old industries in easier and more effective ways. Other chemists and industrialists learn of these new things through chemical conferences and scientific journals.

An industry remade. Consider soap making. In the home of Martha Washington the soap used by the family was made of waste materials. Grease that could not be used for food was saved for making soap. Wood ashes from the kitchen fire were saved. The ashes were put into an ash hopper. Water was poured over them. When the water soaked through the ashes and ran out at the bottom of the hopper, it was a dark-brown liquid called lye. Lye contains potash dissolved from the wood ashes. When lye and grease were boiled together, soap was formed. Soap was made over the kitchen fire for hundreds of years in the homes of Europe and America.

In George Washington's time people in the wooded parts of the United States cut down forests to make huge piles of wood which they burned. From the ashes they made lye. They evaporated the lye and it became potash crystals, spoken of in the trade in the early days as "pot and pearl" ashes. People bought the potash and used it with waste grease from the kitchen for making soap.

Chemists have now learned to take salt brine and coke and, by comparatively simple machines and processes, to make soda ash by the ton. By using this ash together with fats or oils, factories now make soap by the carload in many cities, both large and small, in the United States and Europe.

German leadership in chemistry. During the nineteenth century, most of the students in the universities of America and England were studying chiefly Latin, Greek, mathematics, history, and philosophy. In

Fig. A. In colonial America wood ashes were placed in a hopper and water poured on them. The water dissolved lye from the ashes which was used in making soap.

addition to these subjects, students in German universities were also studying the sciences—especially chemistry. In 1856 an Englishman named Perkin, the assistant to the great German chemist, Hofmann, discovered how to make the dyes now called *aniline dyes* from coal tar.

Before this time, we obtained a red dyestuff from the bodies of little red insects called *cochineal.* To get the dyestuff, the insects were scraped from the cactus plants in Mexico, and their bodies were soaked in water. To get blue dyes, people raised indigo plants. When the stalks were crushed, a yellow juice was obtained. When agitated in the air, the juice turned blue. With it cloth could be made blue in color. Thanks to the start the British chemists made, we can now obtain not only red and blue dyes but several thousand other shades and colors from coal tar.

German leadership in chemical industries. As a result of the science taught in her universities, Germany, for a time, led the world in chemical industries. Germany had raw materials in potash, salt, and coal tar. She bought nitrate of soda from Chile, but finally her scientists learned to make nitrate from the air (page 196).

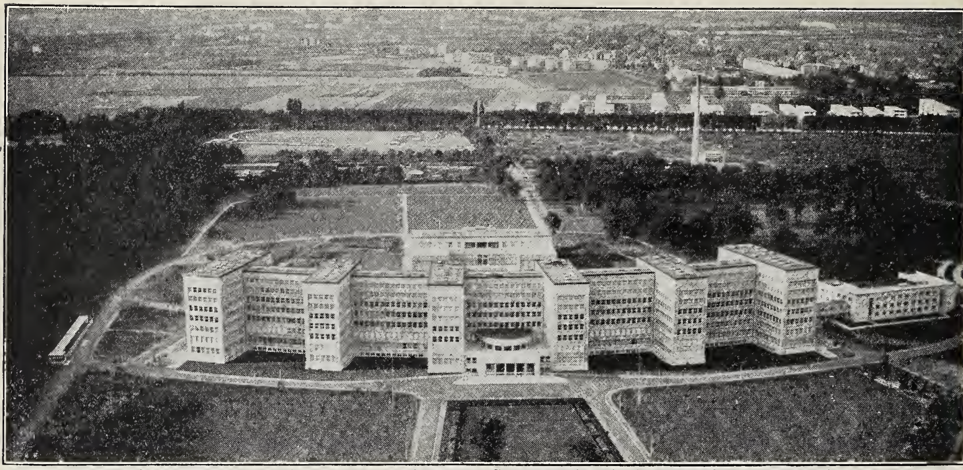


Fig. A. The *offices*, not the works, of one of the large German chemical companies which makes dyes, medicines, photographic materials, and finer chemicals, a total of several thousand products, some of which reach almost every town in the world. They are used as materials in hundreds of factories.

For many years chemicals from scientific German factories were among the chief exports of Germany. During the World War, when American trade with Germany was cut off, American black stockings soon faded to a dull, rusty color. This was because our knitting mills did not have the usual German dyes.

The American chemical industry. Following the lead of European countries, American universities began to teach chemistry and other sciences. Chemical industries developed in America. One company, with its headquarters in Wilmington, Delaware, employs many chemists who do nothing but study ways of making new products. For example, a good paint, easily applied to automobiles, was developed by chemists who studied in laboratories. Cellophane is another laboratory discovery.

Chemical engineering. *Chemical engineering* is a name applied to the process of making machinery that will do easily and in large quantity the things that the chemist can do in test tubes. In chemical engineering the United States has made great headway. In some of our chemical factories, raw materials flow in at one end of a great plant through pipes and, with almost no labor at all, chemical actions take place and the finished product flows out in pipes or collects in vats or bins at the other end of the big plant. These products are ready to sell as the raw material for some other factory or as articles ready for the people to use in one way or another. Every drug store sells many scores of chemical products. Almost every factory uses them.

Explosives. Did you ever think what would happen if there were no dynamite or gunpowder? It would be very difficult to work the rock quarry that gives us material for roads and for cement. To open a coal mine without explosives or to get iron or copper ore would be almost impossible. Indeed, the mining industry, except some open-pit mining, depends greatly upon explosives.

Because it is dangerous to transport explosives, they are manufactured in many different parts of our own country. The factories are located far from the homes of people, in swamps and along river banks, especially those of the Delaware and James rivers.

The fertilizer industry. If the fertilizer industry should stop, the people would begin to be hungry in a few months, be-

cause the agriculture of both Europe and America depends more and more upon commercial fertilizers. The industry had its first great development in the southern part of the United States, where heavy rains leached so much of the fertility out of the soil. There the cotton farmer has used commercial fertilizer for a long time. Fertilizer has also been used a great deal on the Atlantic coastal plain, where the sandy soils have but little fertility in them, but will produce good crops when fertilized.

A seaport is a natural location for the fertilizer factory. At a port, ships can unload phosphate rock from Florida, potash from Germany, nitrate of soda from Chile, bones from Argentina and Australia. The railroads and boats bring produce down to the port and carry fertilizer back to the farms. Therefore we find a fertilizer factory or factories in most of the important seaports from Galveston, Texas, to Eastport, Maine. One of the most important plants in the world for making nitrate is located on the James River a few miles distant from Norfolk, where ocean steamers can load and unload beside the factory.

Other chemical industries. There are hundreds of other chemical industries. We can mention only a few in this book. The manufacture of paints and varnishes, substances which protect and beautify wood and metal, is an important chemical industry. Making dyestuff, for use in giving different colors to cloth and to many objects, is also an important industry.

In 1934 an interesting chemical plant was opened on the coast of North Carolina. It is a bromine factory. Bromine, one of the many substances in sea water, is used in medicine, in photography, in anti-knock gasoline, and in making tear gas. There is one pound of bromine in about 2000 gallons of sea water. Seven years of research developed a process by which this factory gets the bromine from 13,000 gallons of water every minute, night and day. This yields 250,000 pounds of bromine a month. The coast of North Carolina was chosen for the factory because the water there was particularly free from any substances that rivers might carry.

Chemicals in new lands. In its finer forms the chemical industry is not one that moves quickly to an agricultural country like Brazil or the Union of South Africa. The industry requires trained men, skilled processes, a large market. Therefore only the simpler forms of chemicals are made in South America, Africa, and Australia. Thousands of chemicals for drug stores, paint shops, and textile mills go to those distant countries in ships that carry general cargoes from Germany, the United States, the United Kingdom, Belgium, or France.

CHAPTER SUMMARY

Use the following in sentences: chemical, potash, crystals, aniline, cochineal, coal tar, cellophane, explosive, and fertilizer.

What would happen? 1. If we had to depend on the old "pot and pearl" ash industry?

2. If miners did not have explosives?

3. If our fertilizer industry stopped?

4. If we could not get dyes from coal tar?

5. If we did not have large soap factories?

6. If someone built in Peru or Madagascar a great chemical works like the one shown in Figure 274-A?

Write a paragraph to read to the class on one of the following: 1. Chemical action and chemical engineering.

2. Early soap making; modern soap making.

3. Germany and her chemical industries.

4. How explosives aid and harm mankind.

5. The value of fertilizer to agriculture and to the families of the students of our school.

6. Dyestuffs.

7. How the "pot and pearl" ash industry suited the colonial frontier.

8. Some stories told by an old man who once grew indigo and cochineal.

Extra credit. 1. Bring in information about the use of chemicals in your neighborhood. See how many different kinds of uses you can find.

2. Is there mass production in chemical manufacturing?

3. Can you point out any resemblance between the shoe industry and some chemical industries?

4. Find on a can of grocery-store lye the instructions for making soap.

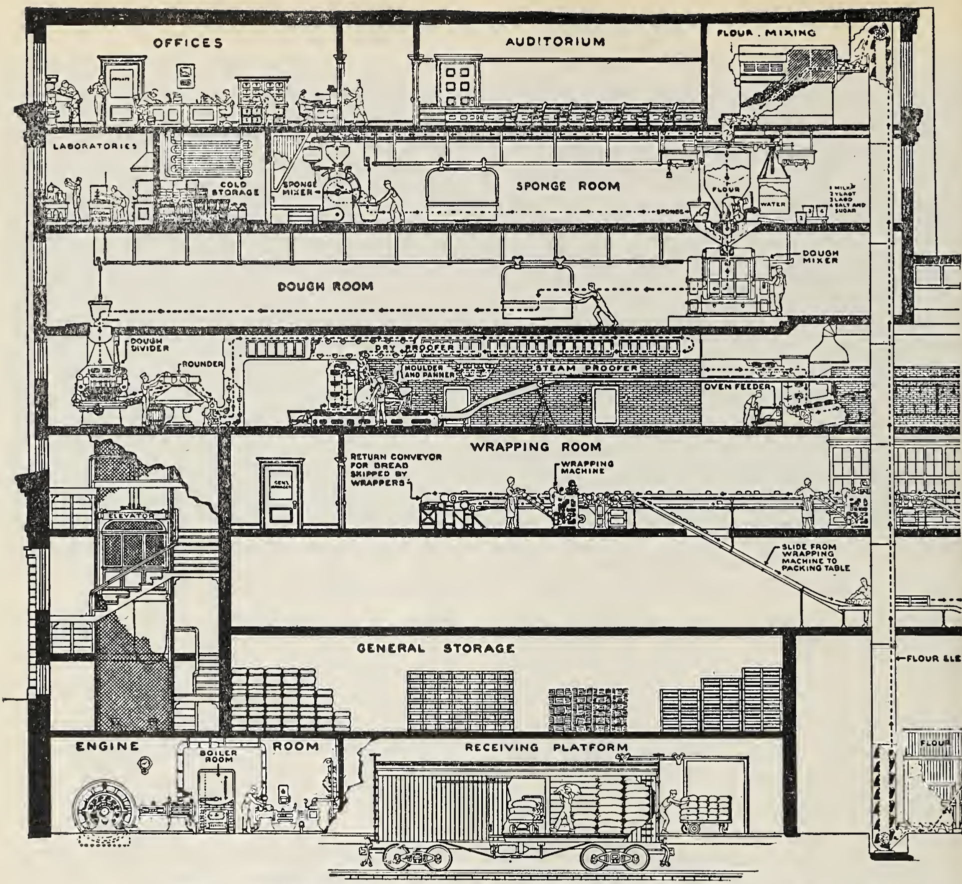


Fig. A. Making your loaf of bread. Trace the story of a bag of flour from the moment it

CHAPTER XXXII

SOME FOOD INDUSTRIES

UNIT 1—FROM HOME TO FACTORY

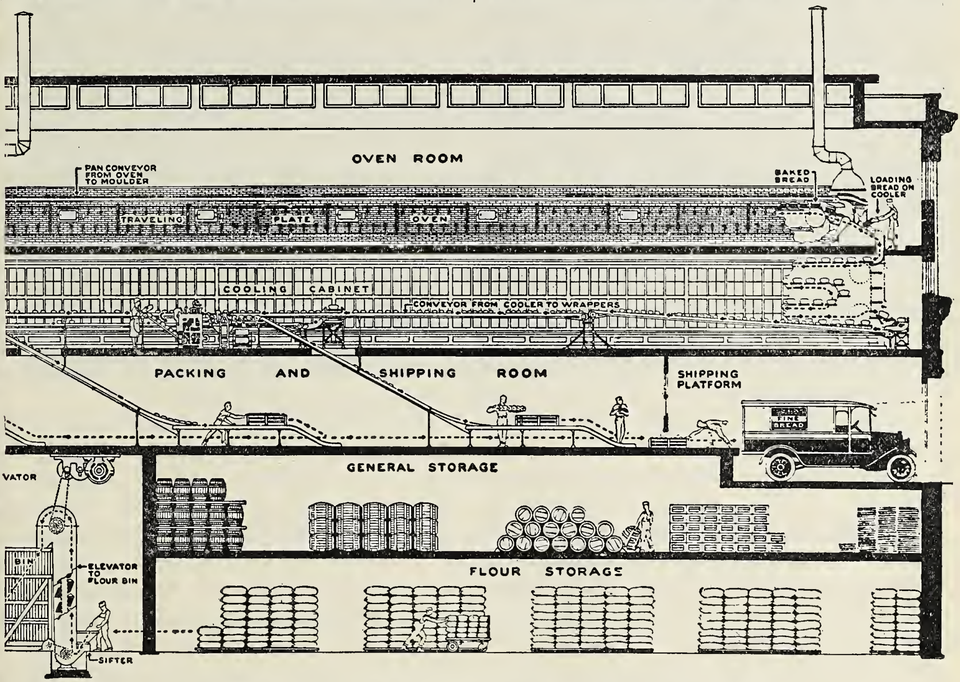
> A CHANGE. Explain the fact that the selling of things is more important to many people now than formerly.

My boyhood farm. When I was a boy, I lived on a farm in northern Virginia. One of my jobs was to carry a sack of wheat or corn across the saddle in front of me as I rode horseback to the country mill (Fig. 302-B). The water wheel of the mill turned the burrstones that ground the wheat or corn into flour or meal.

Bread for the family was made from flour. The bread was baked in the farm kitchen.

In June, I picked cherries from trees that grew along the edge of fields. In July, I picked blackberries that grew by the fences, and I picked huckleberries on the near-by mountain. Some of this fruit was canned at home for use in winter. In August and September, peaches were ripe. I took bushels of peaches from the farm orchard to the kitchen of my home. My sisters and their friends pared peaches by the hour in the

big kitchen while someone read aloud. My mother canned peaches and made some into jam. Others were dried in the farm dryer, an arrangement like a little house with wire shelves and a little stove beneath came the biggest food event of the year—butchering. Several fat hogs were slaughtered and hung up on a pole overnight to cool. The next day the hogs were cut up into hams, shoulders, and bacon. The meat



arrives at the "receiving platform" until it leaves the "shipping platform" as loaves of bread.

them. When my mother wanted to serve a nice dessert, a jar of home-canned peaches often supplied it, together with homemade cake or cookies.

When the family had ice cream, we made it from cream from our own cows. We packed the freezer with ice that we stored the previous winter in the farm ice house.

In October, a big iron pot was filled time and again with apples and cider, and boiled all day to make apple butter.

The cellar was stored with apples and potatoes. In the garden was a mound of cabbages, turnips, parsnips, and salsify, covered with straw and then with earth, to keep them from drying or freezing.

In late November or early December was salted and later hung up in a little windowless house. A small fire of hickory wood burned beneath the hams, because smoke from hickory gives meat a good flavor. Cans of lard were set away in the pantry and sausage was made and stored in jars. Later in the winter, a quarter of beef was bought; part was pickled and part was dried. Today, dried beef can be bought in any meat shop.

Now a group of food industries. Every item on my list of farm foods now represents a factory industry. Sometimes the factory supplies a hundred families or a thousand, or it sends its produce to many parts of the United States and even to foreign countries. Much of the preparation

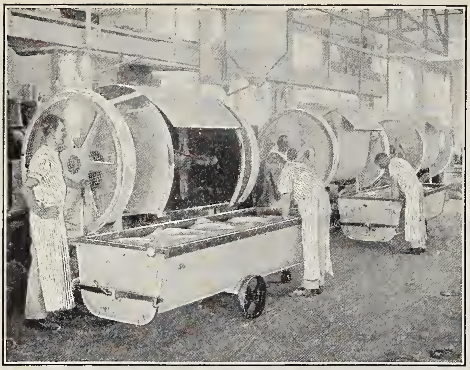


Fig. A. Bread-mixing machines and the troughs in which the dough "rises."

of food in the United States has moved from the homes to town. This was one of the reasons for the great increase in city population between 1880 and 1930.

We could study any one of a dozen food industries, but let us consider some changes that have occurred in the bread industry. The water mill to which I took the grain failed for want of business. Most of the wheat now grown in that county is shipped out and flour is shipped back. Where is the flour made? Wheat *en route* from Kansas or Dakota to New York or Hamburg may, without extra freight cost, stop and be ground into flour and go on again. Thus, cities on the wheat routes became milling centers. The greatest are Minneapolis, Buffalo, Kansas City, Wichita, and Toledo, Ohio. There are large flour mills in almost every large city, and ten or twenty thousand families may be supplied by one mill. Because of this change, thousands of small country mills failed to make a profit and had to close down.

The modern bakery. The big city bakery is an interesting place. Flour comes by the carload into the basement. There are barrels of salt, sugar, grease, yeast, and other materials. An elevator takes the materials to the top floor, where they are weighed on scales in large quantity and dumped through a chute into a mixer on a floor below. An electric motor winds the mixer round and round until the ingredients are thoroughly mixed (Fig. 278-A). The mass of dough is then dumped into a trough on wheels. There it is allowed to rise to the proper state of lightness and is then sent to the story below through another chute.

At last the dough is cut by machinery, the pieces fall into pans placed upon a moving belt which carries them slowly through the ovens. Without stopping, finished loaves come out at the other end of the oven. From flour to bread, human hands have not touched the materials.

Baking is a local industry. Bread, like ice cream, does not keep long, so every city has its bakeries and ice-cream factories, and the bread and cream are shipped short distances to near-by towns. Some companies own bakeries in large cities all the way from the Atlantic to the Pacific.

Bread in Europe. Since most of the farm people of Europe live in villages, they have for centuries been accustomed to having the village baker bake bread for the entire village. But in Europe as in America, the little water mill has failed in competition with the big steam mill in cities, and concentration of the baking industry is taking place as it did in America. Wheat-importing places—Glasgow, Liverpool, London, Rotterdam, Amsterdam, Hamburg—have become milling centers.

THINGS TO DO AND THINK ABOUT

Did you read carefully enough to know:
1. What is meant by the farm dryer?
2. A reason mentioned for the increase of city populations?
3. The leading milling centers in the United States?

A comparison. Compare your life with that of the author when he was a boy on a farm in Virginia. List your comparisons. How many can you make?

The old and the new. See how many different talks you can make with the title, each talk to be on one subject.

A letter to write. If you know some boy or girl who lives in the country (or city if you live in the country), write a letter telling of your life. Ask for a reply telling of the interesting things he or she does each year. Compare the two letters.

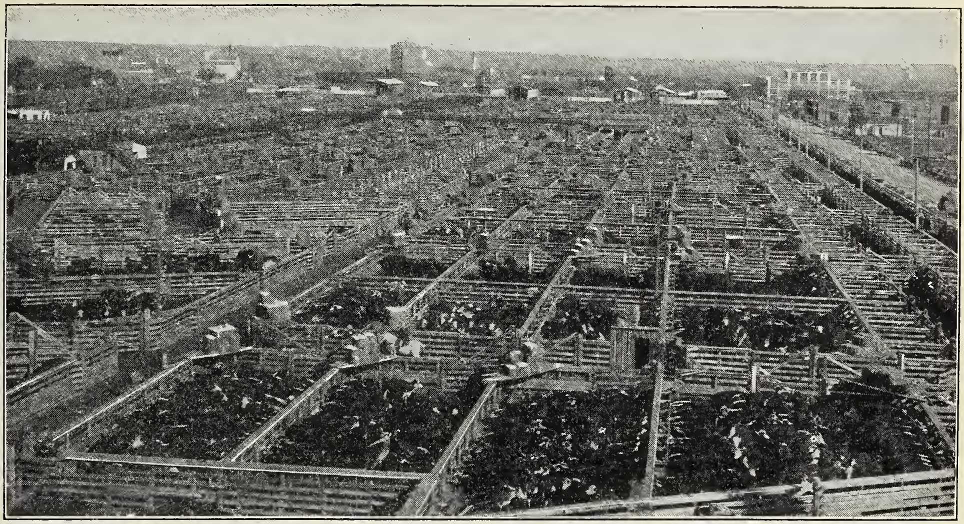


Fig. A. Stockyards at Sioux City, Iowa. Cattle, hogs, and sheep from Corn- and Cotton-Belt farms and Western ranches are unloaded from freight cars into these pens to await their turn in the packing plant.

UNIT 2—THE MEAT-PACKING INDUSTRY

A Choice. Pick out the two inventions that have done the most to change the meat industry.

Freight cars and stockyards. If you happen to be riding in the country near Chicago, you are apt to see a freight train of many cars containing live cattle, hogs, and sheep. The cars for the smaller animals sometimes have two floors—*double deckers*, they are called. Some of the animals may have traveled a short distance from the fattening farms near Chicago (page 100), or they may have come from the Rocky Mountain pastures or from alfalfa stacks in irrigated valleys in the Great Plains.

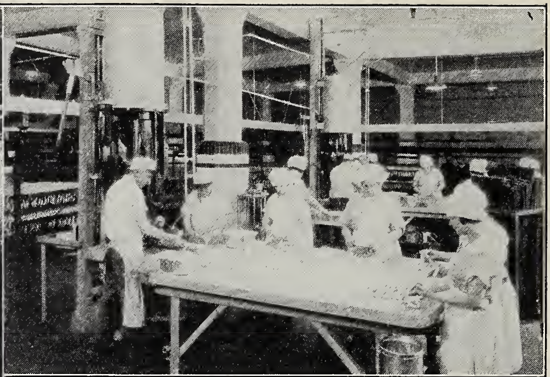
The trains usually arrive in the Chicago stockyards at night.

The stockyards are laid out with many miles of streets like a city. Beside them are pens in which, on almost any business day, one may see thousands of cattle, cows, calves, sheep, and hogs. By an ingenious arrangement of gates, it is easy to separate the animals into different groups and start them along little lanes or by overhead passageways to freight cars for shipment back to farms or to the packing plants which skirt the edges of these hundreds of pens.

Men on horseback ride about looking at the cattle. The men are buyers from the meat-packing companies, or they are sellers representing the commission firms to which the farmers and dealers in the country have sent the animals to be sold. There is much dickering and bargaining before the animals are finally started on the street or overhead way to the packing plant.

The assembly-line idea. The work with the slaughtered animal reminds us of the automobile plant, because the animal rolls along on a trolley past a succession of men each of whom does a small part in dressing it. When finished, the carcass rolls into a cooling room. From here it may be sent to distant meat shops or it may be cut up to be cured or canned.

Many meat products to many markets. Doubtless you have seen the advertisements of some of the meat-packing firms with plants in Chicago and many other cities. These firms sell meat in almost all parts of the United States. You have



Figs. A and B. Mass production of meat products in a packing plant. After the government inspector has certified that the body of the animal is satisfactory for food, it may be made into a great variety of meat products, one of which is the delicious sausage which the girls are packing in the picture above.

also seen fresh meat in the meat market, and canned meat in many forms in the grocery store, but probably you have never seen a barrel of salted and pickled pigs' ears or pigs' faces. I have seen these products in little towns on populous islands in the West Indies. This kind of meat is very cheap. This shows one of the advantages of the great packing plant. It can find in some corner of the world a market for almost any small thing which the farm butcher might have to waste.

By-products. Blood, which is wasted on the farm, is carefully saved in a packing plant. Dried blood is excellent fertilizer. The short hair from an animal's hide, mixed with the plaster for house walls, reinforces the plaster as steel reinforces concrete. Long hair goes to the mattress maker. Bones make buttons and knife handles, and the scraps are ground for chicken feed or fertilizer. The pig has now been made into thirty or forty kinds and grades of meat. The meat may be used fresh, dried, canned, salted, pickled, or boiled for soup. The remaining odds and ends go to the soap-grease vat or to the tankage vat, to be cooked, then it is dried and sold for chicken and pig feed. Certain glands of the animals furnish extracts that are used in making medicines. Altogether, the great packing plant sells many scores of products.

The location of the industry. Small slaughter plants supply the local meat markets in many American cities, but the large plants and the chief packing industries are located in cities in or near the Corn Belt, where most meat animals are fattened. Chicago is the largest meat-packing center in the world. On page 357 find the number of animals slaughtered in some other places. Portland, Oregon; Dallas and Fort Worth, Texas, are some important centers distant from the Corn Belt. Each of these centers supplies many people.

The industry crosses the seas. Suppose, after you have inspected a meat-packing plant in Chicago, I were to show you another plant. Suppose also that there were no people present at the time. As you looked at the equipment and machinery, you would doubtless say, "This must be Chicago again, or perhaps St. Louis." You would be mistaken. This plant is in Buenos Aires, or perhaps Montevideo, or some smaller place up the Paraná River, or in Rio Grande do Sul or São Paulo, Brazil, or in Sydney or Melbourne, Australia, or in Dunedin or Wellington, New Zealand, or even in Madagascar.

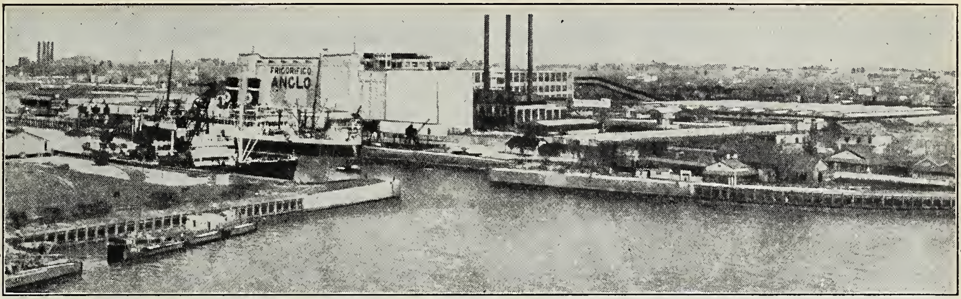


Fig. A. Read the section "The industry crosses the seas" and then tell about this meat-packing plant in Argentina.

Like oil-drilling machinery, textile machinery, and machinery for making shoes, the American equipment for packing plants reached foreign lands where Americans supervised the construction of plants like those in the United States.

It makes little difference to a hungry man in western Europe whether the meat he eats comes from the Eastern Hemisphere or the Western, from the Northern Hemisphere or the Southern. From the homeland or from the Antipodes, meat reaches him in good condition through the aid of the refrigerator ship with freezing rooms or chill rooms, or the meat comes salted, pickled, or canned. The tin can goes everywhere.

THINGS TO DO AND QUESTIONS TO ANSWER

Questions to answer. 1. Why is large-scale packing more economical?

2. Why are railroads compelled to unload stock every thirty-six hours?

3. What other industries have you studied that use the assembly-line idea?

4. How are animals shipped to the packing centers?

5. How are the various parts of the animals used?

For review work. Review Chapter VIII (the Meat and Egg Industries). How does this unit help to complete that chapter?

Simon says "Thumbs up." Make a list of ten statements about this unit. Make some of the statements true and some false. Read your statements to the class. If the statement is correct, everyone should put thumbs up. If the statement is false, everyone should put thumbs down.

UNIT 3—FRUITS, VEGETABLES, AND THE CANNING INDUSTRY

PROBLEM. Explain how a period of depression like that which began in 1929 affects people who can fruits and vegetables.

Rival canning industries. The canning of fruits and vegetables is an important industry in the United States. You can prove it by making a list of the canned goods on the shelves of almost any grocery store, and by staying in a grocery store for half an hour to see what articles people buy.

Any careful housewife, or any girl whose school has a domestic-science department, is able to can fruit or vegetables that will be as good as can be bought in stores. Thus the commercial canning factory may have a million kitchen rivals.

The canning factory. Fruit should be ripe when canned; most ripe fruits cannot be carried far without spoiling; therefore, great city centers for canning fruit do not exist. Instead, the countryside and the small towns in the fruit- and truck-growing regions are dotted with small canning factories. There are large factories in some cities. The largest are in California because that state has the greatest centralization of fruit and vegetable production.

The canning factory cannot operate all the year round, but only when fresh fruit and vegetables can be had. Nevertheless, much labor-saving machinery is used in some canning factories. For example, belt conveyors carry fruit and cans from one

Fig. A. Mass production made the cans and bottles on this grocer's shelves. Mass production filled the containers, cooked the foods, sealed, packed, and carried them by carloads, truckloads, and shiploads everywhere to all continents, many countries, many towns.

place to another; soldering machines seal the cans; scores and even hundreds of cans are lifted into the cooking vats and lifted out by machine power.

The trade in canned goods. Shipping carloads of canned goods from factories in different parts of the United States to wholesale centers and thence to local stores is one of the most extensive trades of the United States. There is also an important export trade in canned goods, because in most parts of the world it is impossible for peaches, plums, and apricots to be grown. Many parts of Europe cannot grow even a tomato. Most people want to buy canned tomatoes; they contain vitamins valuable for health. Tomato juice is a healthful drink.

If business is good. When business is good and people have jobs and money, they buy factory-made canned goods. When jobs are few or money scarce, food canned in the home rises in importance. For example, the home-demonstration work for the state of North Carolina reports that with the decrease in the price of farm products and the increasing difficulty of securing cash, farm women are stretching their income by preserving food for the future. Members of the home-demonstration clubs in North Carolina canned in 1923–28 (average) 835,000 cans of fruit, vegetables, and meat; 1930, 1,328,000 cans; 1932, 4,090,000 cans. Canning meat in the home has not been done very much as yet.

In 1933 I received a letter from a friend who is a missionary in the interior of Anatolia. What does the letter show about the two systems of food supply?

My friend said: "Since there are very few factories, 75 per cent of the people live in villages and farms while 18 per cent are engaged in commerce. Today, with the world suffering from the depression, the great village population of Turkey is hardly affected. True there is *no money* but there is *food* for everyone, old *clothes* are patched again, and all have a *roof* over their heads. . .

"Yes, there is food here even though Turkey's methods of agriculture are most primitive. Near the coast cities, tractors and modern implements are used to some extent, but the farmers soon learned that oxen fed on the farm were cheaper than paying for expensive gasoline and chauffeurs. So oxen plow the fields, the wheat and barley are hand sown, and usually harvested by hand and threshed on the threshing floors by oxen and winnowed by hand in the same way that Ruth saw it done on Boaz's fields. . . .

"The farmers produce enough food (not very varied) so that a village can be shut off from the city store and only lack such luxuries as tea and coffee and sugar. Formerly, each village produced its clothes from cotton and wool. Almost every villager has a few sheep, goats, and cows. The farm tools are very simple—a yoke for the oxen, a wooden plow with a steel point attached, hand scythes, simple shovels.

"Since the farm doesn't produce much

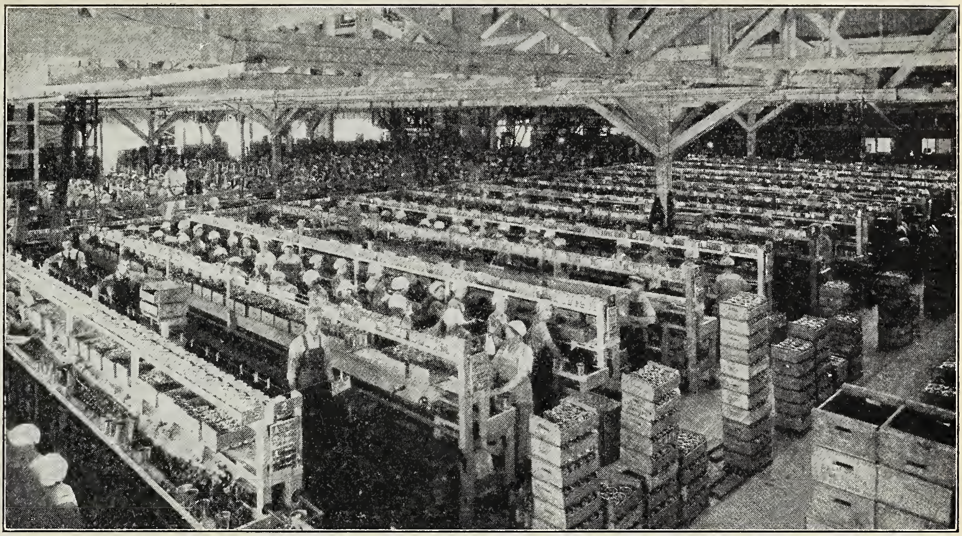


Fig. A. A large fruit cannery in California. The steam cookers are in the rear of the picture. Is this mass production of food? California has many of these factories.

money, there is a yearly exodus in the four summer months of stonemasons, plasterers, and painters to the coast cities for work.

"Half of the boys in our school come from such villages. They have no cash, poor clothes, but good brains and bodies."

THINGS TO DO AND QUESTIONS TO ANSWER

Some why's and how's. 1. Why do we not have great city centers for canning fruits as we do for canning meat?

2. Do different kinds of canning factories have the same length of working season? Explain.

3. What do the figures for North Carolina canning show about the relation between kitchen canning and business activity?

4. What does the letter from Turkey tell you about independence and comfort?

5. Do the illustrations in this chapter show you anything about mass production? Explain. Who can afford to have a laboratory as a part of a food factory?

CHAPTER SUMMARY

The Virginia farm. Is the Virginia farm described typical of the farms located in the commercial parts of the world today? of farms located in the less commercial areas?

Keep a list. Keep a list of the canned goods that you see during one week. Where canned?

Overhead expense. Taxes, insurance, interest on the money invested, and the depreciation of buildings and machinery are called *overhead expense.* They go on whether the factory works or not. A canning factory costs $20,000, charge interest at 6 per cent, depreciation at 10 per cent, insurance and taxes at $2\frac{1}{4}$ per cent. What is the overhead cost a day if it runs four weeks? ten weeks? six months?

Extra credit. Find out what plans the Tennessee Valley Authority (Knoxville, Tennessee) has for food supply and food industries.

Fig. B. The banana has never been marketed successfully either in cans or as dried fruit. It must be rushed to us on refrigerator ships and cars. Through what port do your bananas come?

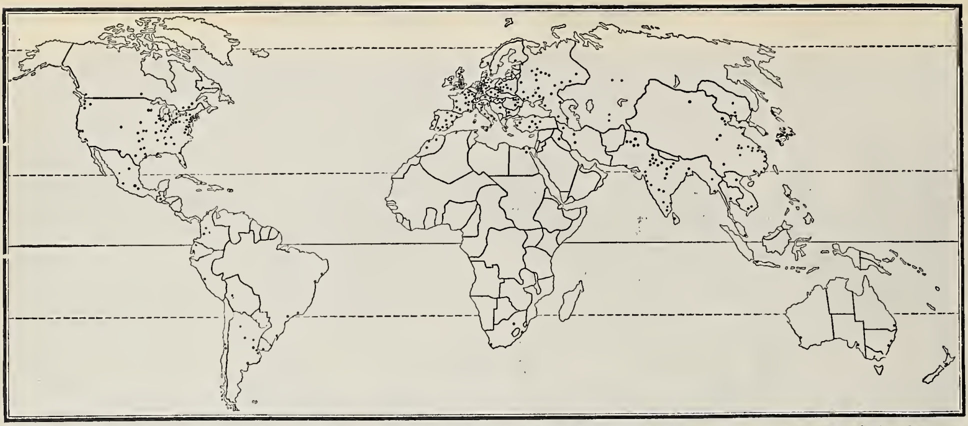


Fig. A. This map of locations of cities of 100,000 or more people shows very clearly where most of the factory manufacturing is done.

CHAPTER XXXIII

MANUFACTURING REGIONS—WHERE ARE THEY?

MANY REQUIREMENTS

A BUSINESS PROBLEM. If a young man wished to migrate from a little mountain farm in Yugoslavia to a place with a promising future as a manufacturing region, where might he go? Where should he not go?

What manufacturing needs. We have seen that many European people have settled in all continents since the steam engine was invented. They took with them the animals, plants, languages, and knowledge of Europe. We have seen that they built up in new continents the cattle industry, the sheep industry, and the wheat industry. We have seen that some of the products of these newly established industries are produced chiefly in places newly settled by Europeans, such as Argentina, Australia, the Great Plains of North America. To move manufacturing is not so easy as it is to move production. Why is this true? See the needs of manufacturers (page 207) and the starting of new manufactures (pages 248 and 257).

Find the manufacturing city. Where the conditions for manufacturing are good, cities may arise. Can cities be located just anywhere? Which regions are best *equipped for manufacturing?* How much *manufacturing already exists* in those regions? To find answers to these important questions, we must examine some of the climatic regions of the world.

1. *The tundra.* Where are the tundra regions (Fig. 2-A)? These are the lands of the reindeer people, fishermen, hunters, and nomads; lands where meat, fish, furs, hides, and skins are most important in the lives of the people. However, except for a few boat-landing places with a dozen or two houses, there is not a town in the whole length of the tundra. If the tundra inhabitant gets the chance, he is glad to trade skins and fish for rifles, traps, and tents. Trading relieves him of having to make (manufacture) all the things he needs. It is evident that a young man who wants to leave Yugoslavia will not find in the tundra an opportunity for manufacturing.

2. *The cold plateaus* (Fig. 2-A; regions numbered 6). These regions have a climate most nearly like that of the tundra. In the cold plateaus there are no towns worth mentioning here, with the exception

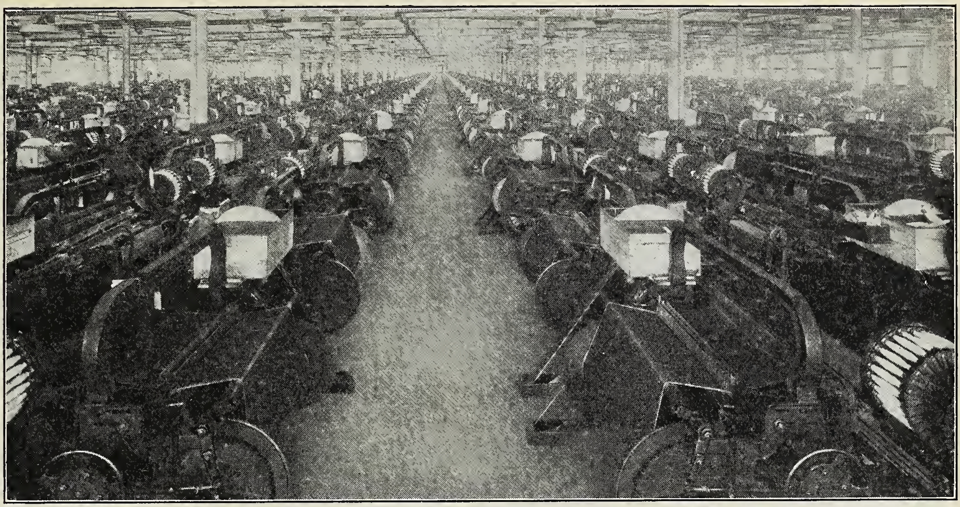


Fig. A. Thousands of looms, practically automatic, weaving cloth at Greensboro, North Carolina. Find Greensboro on the map (Plate I). The Piedmont of Georgia and the Carolinas has many such manufacturing centers.

of a few places where there is rich metal and where mining towns have grown. Thus, Potosí, a mining settlement on the treeless and shivery cold plateau of Bolivia, was by far the largest town in America in 1650. Now that the mine yields little, Potosí has but a small fraction of its former population. It produces no manufactures for export and few for its own use.

3. *The Great Northern Forests of Europe, Asia, and North America* (Fig. 2-A; regions numbered 7). These vast regions are lands of (*a*) the trapper; (*b*) the prospector; (*c*) the lumberman.

(*a*) The trapper's town is a trading post—a store with two or three houses around it.

(*b*) Prospectors are now flying in by airplane (page 235) for summer prospecting in northern Canada (Fig. 236-A) and flying out in the fall. If metal sufficiently rich is found, a railroad will be built. A railroad was built to the rich mines of silver, gold, and nickel in the Canadian forests northwest of Ottawa.

(*c*) Sawmill and pulp-mill towns exist along the coasts of Sweden, Finland, the Gulf of St. Lawrence, and on some of the Siberian rivers. These towns furnish the only manufactured exports—exports derived from only a tiny fraction of those vast forests—forests whose extent is several times as great as that of all the plowed fields of Europe and the United States.

4. *Deserts* (Fig. 2-A; regions numbered 3). The deserts are large enough to cover all the populous parts of western Europe, eastern North America, China, and Japan. The deserts, like the Great Northern Forest lands, are without towns unless rich minerals are found. Then a railroad may come, as it has to Broken Hill, Coolgardie, and Calgoorlie, mining towns in the Australian deserts. The Atacama Desert on the rainless coast of northern Chile, with its nitrate deposits, has had some of the most remarkable desert cities in the history of the world. Such cities thrive only while the mineral business has thrived. They have declined as it has declined. They will die when the mine dies.

5. *Equatorial forests* (Fig. 2-A; regions numbered 1). In these parts of the world nature is most productive. There is never any cold weather to interfere with the growth of plants. The land is a veritable riot of tree growth, rich with coconuts, oil palms, cacao trees, rubber trees, Brazil-nut trees, and many other trees whose products

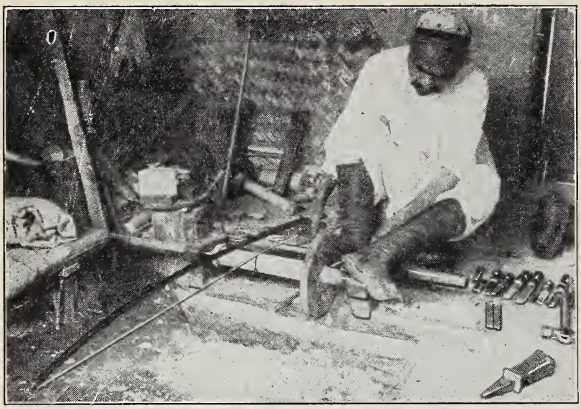


Fig. A. The follower of an ancient handicraft. The wood turner sits on a cushion, turns his wood with the bowstring as he pulls the bow back and forth. He holds the chisel with his left hand and guides it with his heel. This might be seen almost anywhere between Chosen (Korea) and the Nile, the Indian Ocean, and the Siberian wheat belt. ¶ I have seen these workers use their toes almost as we do our fingers. ¶ The Russian Government has now begun to build factories and is teaching some of these people to operate machines in the Western way.

are or might be useful to man. Do great cities arise in these lands of tropic abundance as they do in colder Europe and North America (Fig. 286-A)? At the mouth of the mighty Amazon, king of rivers, is Pará, a town not now prosperous, because her rubber business has declined. At the mouth of the mighty Congo is Boma, a little shipping port.

Asia has several cities in her tropic forest land. India boasts the largest city of all the tropic forest lands. Calcutta, with a million population, is the only city of the tropic forest whose manufactures provide an important export. Jute from the adjacent flood plains is there manufactured in many textile mills into jute cloth, used for bagging and sacks for bulky raw materials like wheat, coffee, and wool. The mills of Calcutta use European machinery and are operated under European superintendents.

The other large tropic forest cities of Asia—Bangkok, Rangoon, Colombo, Manila, and Singapore—are ports where people are employed chiefly in handling local raw materials and doing some manufacturing for the home market. In these cities nearly all of the larger industries are managed by foreigners. Singapore exports canned pineapple, a local raw material.

6. *Tropic grasslands* (Fig. 2-A; regions numbered 2 and 2A). These vast stretches of rainy-season and dry-season lands produce grass, cattle, goats and woolless sheep, sorghum, millet, and cotton. There are few cities in the tropic grasslands of all continents except Asia. In Africa there is Kano, on a bit of highland in Nigeria, cooler, rainier, more productive than the adjacent grasslands. When the white men first came, Kano had 40,000 people and a hand industry in manufacturing cotton cloth. But could you expect Kano to become a manufacturing town today in a hot land of uneducated people without coal or water power?

Katanga and some other mining towns are the only towns in the African grasslands south of the Equator. There is no town worth mentioning in the tropic grasslands of Australia or South America. If there is a port, it is merely a place for loading and unloading goods and, perhaps, a meat-freezing plant.

The tropic grassland in India is the only section that has produced cities of large size. For ages the Indian grasslands have received fresh lots of people coming in from the cool grasslands and plateaus of Iran and Central Asia. For ages, in the cities of India, the ancient handicrafts have been handed on from father to son. Today thousands of skilful hand workers continue the ancient trades. They make wares of metal, wood, ivory, leather, and fabrics of many sorts with beautiful embroideries and block printing.

Under British rule, European and native capital have built factories like those of Europe. Especially to be noted are the cotton manufactures of Bombay and other

cities in parts of India having a long dry season as a part of the climate. The Indian sometimes copies the British by building and running cotton factories entirely without the aid of Europeans. The Indian iron industry (page 218) is, in the main, typical of the modern manufactures. This enterprise was copied from Europe. European machinery is used, and the superintendents are Europeans. The iron supply does not quite meet the needs of the home country. As a result of cotton and jute being made by the machine method, India has begun to be an exporter of manufactures.

Fig. A. An equatorial forest industry. Natives of Cameroon, West Africa, weaving on the simplest form of loom known.

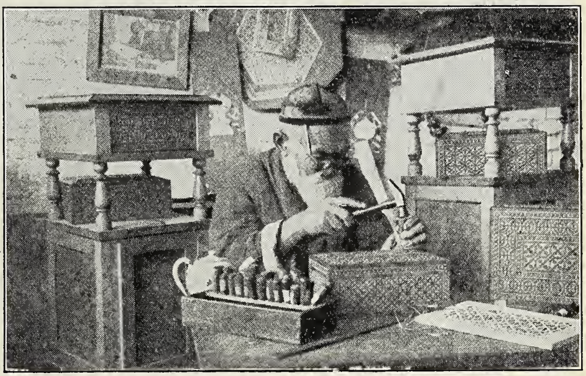


Fig. B. The wood carver of Tashkent, with his teapot on the work bench, does beautiful work. For ages Tashkent was one of many isolated settlements in a vast caravan land. Commerce had to be light, but the craftsmen sent fine and beautiful wares—carvings, jewelry, leather work, the finest textiles, spices, and perfumes.

7. *The temperate grasslands* (Fig. 2-A; regions numbered 4 and 4A). These far-spread lands of shepherds, nomad herdsmen, and cowboys produce most of the world's wool, but the wool is manufactured into cloth in lands far distant. The temperate grasslands produce many of the world's meat animals; also many animals are sent from the grasslands to be fattened in the corn belts. If the animals happen to be slaughtered in the land of their growth, this industry usually produces only a small town with stores and slaughtering plants, such as Magallanes on the Strait of Magellan, and similar towns on the near-by coast of Patagonia (southern Argentina).

Many of the temperate grasslands are mountainous, and the mountains have two things that cause cities to appear in the surrounding grasslands. These two things are *minerals* and *snowfall*. Melted snow produces the precious water that runs down from the mountain to irrigate the choice spots in the plain.

At the foot of the mountains in one of these temperate grasslands are three important cities: Denver, Salt Lake City, and Spokane. Near each city are irrigated lands which yield food for man and beast. Near each city also are areas of plateau with less heat and more rain than in lower lands. The cool weather and greater rain make dry farming possible in small areas. In each of these cities are supply houses which sell equipment and repairs for mines and ranches. Each city is the commercial capital of an area as large, perhaps, as the United Kingdom. Most of their manufactures consist of the products of slaughterhouses, creameries, canneries, and sawmills. Many other plants supply only the needs of the city and surrounding

Fig. A. Baking bread in the village oven in New Mexico. This method is many centuries old. Such houses of sun-dried brick and plaster may be found in southwestern United States, Mexico, Chile, Argentina, and from Morocco to Manchoukuo, but they are not yet the settlements of modern manufacturers.

territory—such as newspaper printing, bakeries, ice-cream and ice factories.

In the temperate grasslands of Asia are situations like those of Denver, Salt Lake City, and Spokane. Damas (Damascus), at the foot of the Lebanon Mountains, is on a rich plain irrigated by snow water that flows eastward from the mountain to a salt lake in the desert. Similarly located are Tehran, Isfahan, and every Persian city. The same is true of Tashkent, Samarkand, Bukhara, Merv, and every other large city of Central Asia; also of Herat and Kabul in Afghanistan. These cities are all thousands of years old. The sons and grandsons and great-grandsons of the ancient craftsmen still sit in their booths working as their ancestors worked in the time of Columbus, of Christ, and of Alexander the Great. Now many of these old-style craftsmen are complaining of the hard times caused by the factory goods that flow in from Europe and America.

Raw-material regions. We have glanced at regions that cover by far the greater part of the earth's surface. None have we found suitable for a manufacturing region—even of the fourth degree. All are *raw-material regions.* All send out raw materials. All import manufactures.

Manufacturing usually arises where agriculture has already supported a considerable population, but the place must also have the particular things needed for the successful factory (page 207).

CHAPTER SUMMARY

A study of the earth's regions. Make a list of the regions mentioned in the chapter. After each write the reasons for its being or not being an important manufacturing region.

For review. Turn back to Chapter XX, Unit 4, and review the needs of every industry. What does this review show you about the regions mentioned in this chapter as places for manufacturing industries?

Discuss. The relationship between raw-material regions and manufacturing regions.

A relay race. Make a list of the names of the cities mentioned in this chapter. Elect two captains. Let each choose his side for the race. Let each side take turns as follows. The captain will name a city and call upon the first one on the other side to go to the map and locate it. If he fails, he must drop out of the race. If he succeeds, he can then name a city for the next person of the opposite side to locate. Which side has the most runners at the end of the race?

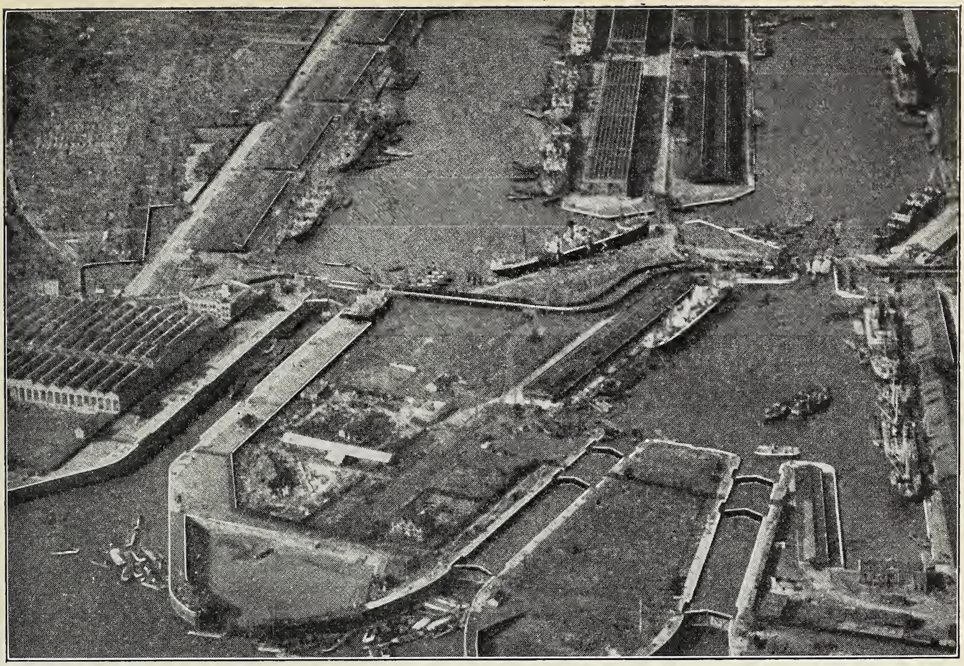


Fig. A. Two of the many docks that have been made in the meadows beside the Thames in London. The tide here is sometimes 20 feet high. This is inconvenient and lets ships down on the mud unless the water is very deep. Find the gates by which water is kept in the docks at low tide. At the left, several little boats at the lower level are in a lock between two gates. Do you see how they can be lifted up to the higher level of the docks?

CHAPTER XXXIV

MANUFACTURING REGIONS

UNIT 1—UNITED KINGDOM, THE OLDEST MODERN MANUFACTURING REGION

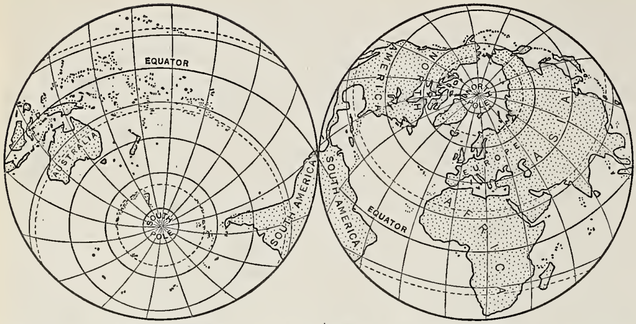
A QUESTION OF TRADE POLICY. Should England export coal?

A necessary basis for manufacturing. The United Kingdom got a favorable start in manufacturing because it had a number of necessary resources. First, it had laborers, because the country was well suited to farming. This gave a food supply to support people.

The soil of the United Kingdom is fertile. The climate is good. The rainfall is regular. Consequently, the country has been very free from crop failures and famines which curse so many countries. The entire United Kingdom is land good for grass, thus giving food for sheep, cattle, and horses both summer and winter. It is a land good for grain (page 356), thus giving a dependable bread supply. The climate is healthful, cool, and stimulating.

Early handicrafts. Spinners and weavers, shoemakers, saddlers, potters, cutlers and other workers in metal, lived in cottages in the country, and they and their families tilled small tracts of land before the industrial revolution.

The early start due to machines and power. It was natural that, since so many hundreds of people were working at textiles, someone should invent spinning and weaving machinery. The abundant rainfall of the hill country had long been used to turn water mills. So water power was



Figs. A-B. These maps show the division of the earth into two hemispheres: the water hemisphere is at the left and the land hemisphere at the right. What does it show about the opportunities for trade in New Zealand and the United Kingdom?

waiting to run textile machinery as soon as the machinery was invented. The steam engine soon followed. For this Britain's coal was handy, and she was lucky enough also to have iron near to the coal and near to the sea. For fifty years (1790–1840), while the people of America were planning and working to build canals to bring coal from the mountains of Pennsylvania, Britain was lifting her coal from mines beside the sea at Newcastle and from other mines beside the sea at Glasgow and in South Wales. Coal mines beside the sea permitted coal to be carried by boat directly to London and elsewhere. The first British canal in 1761 carried coal ten miles to Manchester. This means of transport reduced the price of coal from about twelve pence a hundredweight to four pence. This reduction in carrying charges made Europe and the United States interested in canals.

With coal and iron ore beside the sea, the United Kingdom got an early start at textile manufacturing. She also got an early start in the iron and steel industry. Half a century before any other country was doing much with the products of these two great groups of industries, the United Kingdom was selling textiles and iron and steel manufactures, far and wide, in every continent. How did this affect hand workers?

A location good for trade. Look at the globe in such a way that you see the British Isles as the center of a hemisphere. Then look at the place exactly opposite on the other side of the world. What can you say about a land hemisphere and a water hemisphere? Look again at the globe with the British Isles as a center. Notice how they stand at the gate to Europe, in a location from which it is easy to reach every country of Europe.

Factories rise and farms decline. By the middle of the nineteenth century, Great Britain had been prosperous so long that her factories had grown, her population had increased, her cities had increased, and her own fields could no longer feed the people. Should or should not the tariff be taken off grain was a question that Englishmen debated for twenty years. If grain were admitted free from all countries, the people would have cheap food. If imported grain paid a tariff, food for the people would be dearer but the farmer would have larger profits. The people decided against the tariff. Grain was to be admitted free, and so the era of *free trade* began. Shortly afterwards the railroads began to carry grain, and the farmers began to settle on the black-soil belts (page 68 and Fig. 68-A) of North America, Russia, Hungary, Argentina, and Australia. This development made food cheaper than ever before. The low price of grain made it unprofitable for the United Kingdom to grow wheat on many of her small fields. And so the cottage worker moved to the city. No other country in the world has so large a percentage of its people living in cities as has the United Kingdom. What does Figure 286-A tell you about this?

The black-soil belts which fed the British were developed in large part by British capital or manufactures. British iron made the rails for many of the new railroads, also

the locomotives and sometimes the freight cars. Today the railroads of Argentina are owned by British companies; the cars and locomotives come from Great Britain, as does most of the coal for the locomotives. British companies own and British factories equip railroads in many countries.

Great variety of industries. Having had an early start in the textile industry and an early start in iron manufacturing, Britain had the machinery to make machines. She began to make textile machinery as soon as it was invented. As machine after machine was invented, Great Britain built factories to make the machines. Today her central coal and iron region, reaching from Liverpool to Leeds and south through the center of England, including Sheffield and Birmingham, makes a greater variety of machines and metal goods than is made in any other small part of the world. If the farms and little towns of Tasmania or Tanganyika, of Ceylon or Costa Rica, of Finland or Falkland, want nails or knives, pins or pumps, motors or machine guns, engines (gas or steam), satchels or silk hats, or indeed any kind of house furnishings, farm furnishings, factory furnishings, men's wear or women's wear, drugs or medicines, they know that Britain has the factory to make it and an export firm to sell it.

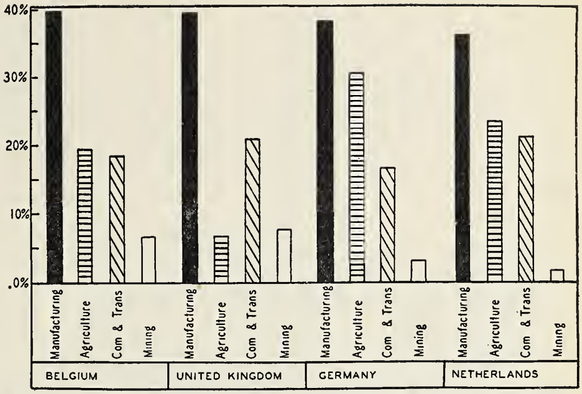


Fig. A. These graphs show percentage of gainfully employed persons in four countries. Compare the all-round development of the different countries.

London's industries. London, the capital of the British Empire, is also the greatest manufacturing city. Twenty million tons of shipping come to its river harbor. Ships come from every continent and every British port. London is also a great railroad center. More than 8,000,000 people live in London and vicinity. To provide for the needs of this vast population, large amounts of many articles are needed. London, therefore, has a great variety of manufacturing industries instead of one great industry.

The United Kingdom's leadership in shipbuilding. People who live on an island naturally must go much to sea. The manufactures and foreign trade of the country require many ships. In 1850 America had the supremacy of the sea with her wooden sailing vessels. In 1860 English iron steamers had beaten the sailing ships; and from that time to this Britain has had the greatest fleets of ships and the greatest shipbuilding industry in the world. Her shipyards at Newcastle, Sunderland, Glasgow, and Belfast build dozens of ships, all of which are alike. In this industry they have the advantage of standardization and mass production. Ships were and are one of Britain's main exports.

UNDERSTANDING BRITAIN

The British situation. Go over the list of things that a nation needs for manufacture, and see how the United Kingdom is equipped. Compare her assets with those of the equatorial forest.

England at the crossroads. On an outline map of the world show the route that a steamer would take in going to and from the following places: Oslo to Argentina, Stockholm to Cairo, Köbenhavn to New York, Danzig to Montreal, Hamburg to New Orleans.

For study and investigation. England's industries have developed because of her deposits of coal. How much coal has she already used? How great a supply is left? How does this affect England's future possibilities as a manufacturer?

Facts and ideas. Make a list of the important *ideas* in this unit; facts.

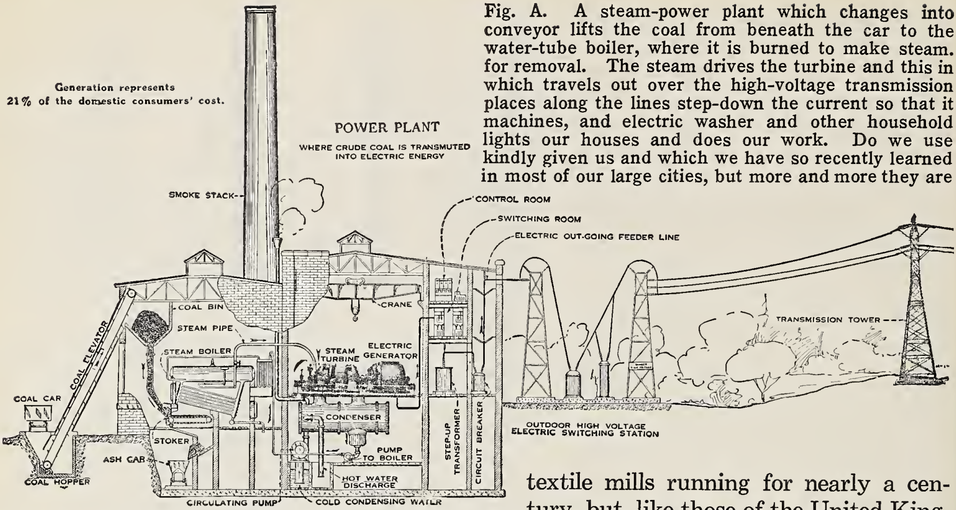


Fig. A. A steam-power plant which changes into conveyor lifts the coal from beneath the car to the water-tube boiler, where it is burned to make steam. for removal. The steam drives the turbine and this in which travels out over the high-voltage transmission places along the lines step-down the current so that it machines, and electric washer and other household lights our houses and does our work. Do we use kindly given us and which we have so recently learned in most of our large cities, but more and more they are

UNIT 2—THE NORTHEASTERN COAST REGION OF THE UNITED STATES

> THE FUTURE. Are New England and old England likely to resemble each other in the manufacturing changes that will probably come? Why or why not?

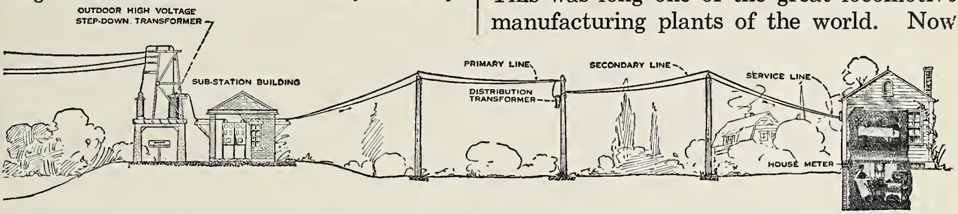
America uses machines. At the time of the Industrial Revolution the British Government thought it would be a good thing to keep the new industries at home, therefore no machinery was allowed to be exported. But laws could not control men's minds. An English workman went to Rhode Island, and from memory built spinning machines. The young men and women from the small, rocky New England farms flocked to the new textile mills which arose beside scores of waterfalls in Rhode Island, Massachusetts, Connecticut, southern New Hampshire, and southwestern Maine. You have already read about the woolen industry (page 251) and the cotton industry (page 247). There is not a coal mine in all of New England, but her glacial lakes serve as reservoirs for water storage and thereby furnish much more water power than the United Kingdom has. This water power kept New England's textile mills running for nearly a century, but, like those of the United Kingdom, the mills outgrew the local water power. Then many New England mill owners had to install engines which were fed by Pennsylvania coal.

America builds machinery. As old England had done, so New England began to build textile machinery, then other machinery, and later, machine tools to make the machinery. Thus New England has varied industries.

Since coal and iron must be imported from other states, the New Englanders make the most of their raw material by making a great many small tools and fine goods like skates and firearms, clocks, brassware, cutlery, and jewelry. Connecticut makes more hardware by far than any other state. Do New England's great textile and shoe industries resemble other New England industries?

Abandoned farms. The cheap grain from the level black-soil plains of the Middle West caused the rougher and more rocky farm land of New England to be abandoned, just as cheaper grain in old England had caused land abandonment there. As in old England, so in southern New England, people left the farming regions for the cities. Is there a great number of cities in these states (Fig. 286-A)?

electricity the energy Nature put into coal. An endless bin. An automatic stoker carries the coal under the The ashes pass down through the ash pit to the ash car turn drives the electric generator. The electric current lines is too powerful for ordinary use. Substations at can be used to light your house and drive your factory appliances. The stored sunshine of an ancient day well these amazing resources that Nature has so to use? Such power plants as this are to be found being built at the coal-mine mouth. Can you tell why?



The New York district. How far from New York is Scranton, Pennsylvania, in the anthracite coal region? How far are Bethlehem, a steel center, and Allentown, a cement center? You remember the canal to the Great Lakes. With this in mind, make a list of the manufacturing advantages (page 207) of New York and vicinity. New York with its industrial suburbs has become the greatest manufacturing center of the United States. It is to America what London is to the United Kingdom—a great home market whose factories manufacture some of almost every article that is made in the United States. The chief things manufactured for other than local use in the New York district are clothing, machinery, and ships. The State of New York leads the United States in shipbuilding.

Philadelphia and neighboring districts. Philadelphia, like New England, began with a textile industry. She now specializes in woolens and carpets. Philadelphia is nearer to the coal region than is New England. A century ago iron was made in and near the city. This helped Philadelphia to develop the manufacture of machinery and ships.

In 1830 a Philadelphian named Matthias Baldwin saw one of the first locomotives imported to this country. He looked it over carefully, spent nearly half an hour under its boiler, and exclaimed as he came out, "I can make it!" Mr. Baldwin first made a working model for the Philadelphia Museum. Then he began building railway locomotives. His work outgrew one shop after another. Mr. Baldwin then established the Baldwin Locomotive Works at Broad and Hamilton Streets, then in a suburb. This was long one of the great locomotive manufacturing plants of the world. Now the company has outgrown its city plant and has great plants at Eddystone, ten miles down the Delaware River, near Chester.

There are important shipyards in Philadelphia and in Camden across the river. The shipyards, machine shops, and textile mills call for machine tools, for which Philadelphia is an important center.

Chester and Wilmington have industries much like those of Philadelphia. Trenton, up the Delaware River, has important rubber works and wire works, but her great specialty is pottery. The potters first used local clay. Later, clay was imported from distant states and from England and manufactured in dozens of plants. Hundreds of kilns burn clay into a great variety of porcelain and earthenware goods, including dinner ware, bathtubs, and much electrical apparatus.

Harrisburg and Bethlehem, inland neighbors of Philadelphia, have steel works for their chief industry. In the valley near Bethlehem is the greatest cement manufacturing district in the world (page 240).

Manufactures at Baltimore. Baltimore's iron furnaces melt ores imported from Cuba and the Lake Superior district. She also has steel mills and shipyards. But in the main, Baltimore has a variety of manufactures. As a basis for manufacturing, this city has a low cost of living. She is close to Appalachian coal, and electric

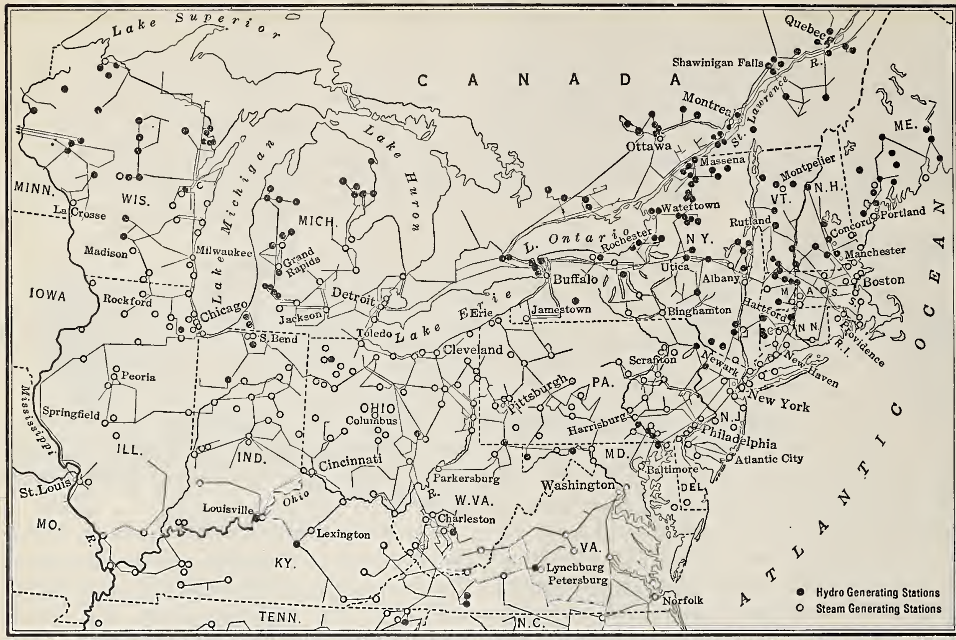


Fig. A. This map shows the locations of the larger stations which generate electricity by water power (black dots), or by steam power (circles), and of high-power transmission lines which carry the power to cities.

current comes by wire from huge water-power plants on the Susquehanna River. Baltimore has one of the most wonderful food supplies in all the world. Chesapeake Bay is particularly rich in fish and oysters. The sandy lands of the coastal plain have long been one of the greatest trucking regions. The peach and apple districts of the Potomac Valley are near by. Many kinds of fruit and vegetables are within easy access of the city. Farms on the clay land of the Piedmont produce good grass, abundant milk, butter, wheat, and corn.

Advantages of New York, Philadelphia, and Baltimore. These three cities have coastwise and ocean steamship lines. They are on the main lines of railroads running from Boston to the South. Also, they all have many trains each day to Pittsburgh, Chicago, and the West. This helps to explain why there is so much manufacturing done in southeastern Pennsylvania, Delaware, and New Jersey.

The coast cities have industries using oil, coffee, sugar, spices—raw materials that come by sea.

PROBLEMS AND QUESTIONS

Do you know these things about our northeastern-coast region? 1. How much coal had New England?

2. What power made possible early manufacturing?

3. Why does New England manufacture so many small articles?

4. The ways in which New England resembles England.

Finding facts. Find and write down four facts about each of the following districts:

The New York district, the Philadelphia district, the Baltimore district.

A review project. What raw materials have you previously studied about that could easily be assembled by shipload or carload at Baltimore, Wilmington, Chester, Philadelphia, and at Trenton by barge from Philadelphia; at the cities on New York Bay, Providence, New Bedford, Boston, and Portland?

Reports. Prepare a report: 1. Showing how Nature provided New England with the qualities to become a manufacturing region.

2. Comparing the Baltimore district and the Boston district as places for manufacturing.

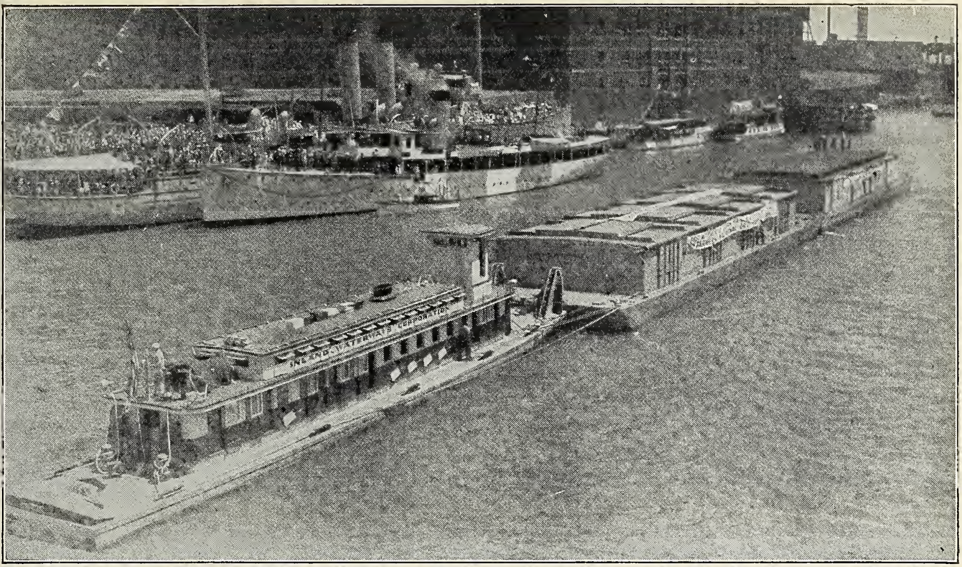


Fig. A. Chicago celebrates. The pretty steamer in the center is the reception boat with mayor, city officials, and distinguished guests welcoming the arrival in Chicago Harbor (1933) of the first barges from New Orleans. This was the formal opening of a new waterway, nine feet deep, through the Chicago drainage and ship canal and the Chicago River. ¶ The two barges have cargo space, 96 ft. by 28 ft. by 8 ft. 4 in. They will carry 400 tons on five-foot draft. The tug at the left foreground will pull five such barges and has a pilot house that descends to go under low bridges.

UNIT 3—THE GREAT LAKES MANUFACTURING REGION, ITS NEIGHBORS AND OUTLETS

> Are They Right? Prove or disprove the claim of the people who live between the Ohio River and the Great Lakes: they say that they live in the industrial heart of the continent.

Chicago, Milwaukee, Detroit, and the cities of Lake Erie—Toledo, Cleveland, Sandusky, Erie, Buffalo, and their many suburbs. The locations of these cities offer many advantages. The cities are near the center of population of the United States and therefore are close to markets for their products. They are on the edge of the great level plains, which make it easy for railroads to carry city wares to market and to bring back to the cities the great food supply of the rich farm lands. These cities are also near to the coal of Appalachia, Ohio, Indiana, and Illinois; to the iron of Pittsburgh, Buffalo, and Chicago; to the wood of the upper Great Lakes. Lake boats assemble raw materials cheaply. Then, these centers have outlets to the eastward and to the sea by way of the St. Lawrence River, the New York State Barge Canal, and the many trunk-line railroads. It is natural that Buffalo and these other cities should have a great *variety* of industries.

The Ohio Valley cities. Pittsburgh, Wheeling, Charleston, Portsmouth, Louisville, Evansville, and Cincinnati with its neighbors, Hamilton and Norwood, have locations that are almost as good as those of the cities on the Lakes. The Ohio Valley cities are closer to the Appalachian coal and lumber. Steamboats and barges on the Ohio carry Pittsburgh coal and steel to every river town.

The iron and steel triangle. In thinking of this region we should read again on page 213 the facts regarding Buffalo, Pittsburgh, Chicago, and iron and steel.

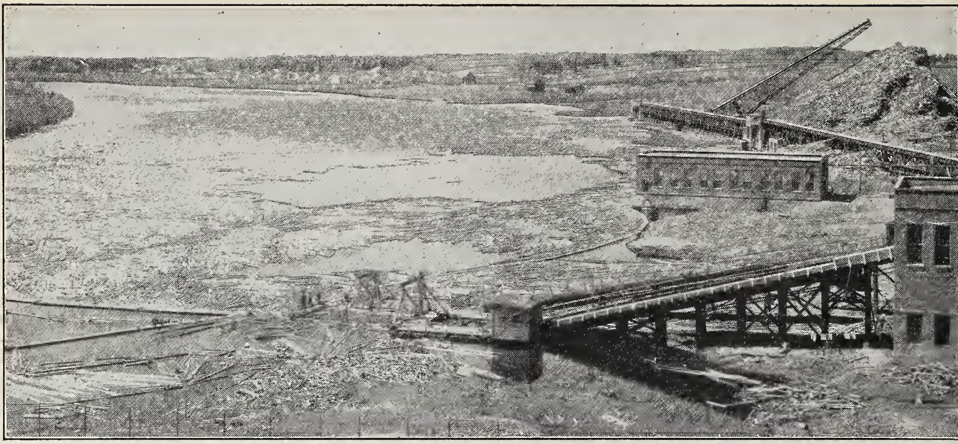


Fig. A. Find cheap transportation of pulp wood, log boom, and mechanical contrivance to move sticks into the mill or to the storage pile. Point out places in three continents where scenes like this one from the St. Lawrence basin in Canada may now or some day be duplicated.

The upland cities between the Lakes and the Ohio. The network of railroads between the Great Lakes cities and the Ohio Valley cities gives to intervening territory quick and cheap assembly of the heavy raw materials. In every direction one sees the freight train with its string of coal cars, carloads of iron, steel, or machinery. With this assistance Columbus, Dayton, Springfield, and Marion, Ohio, and Indianapolis and Fort Wayne, Indiana, have grown to be important manufacturing cities.

Heavy industries. The raw materials of the inland region give it heavy industries—meat packing, flour milling, and, above all, iron and steel and machinery. We have already studied about agricultural machinery, automobiles (page 256), machine tools, and tires (page 260), but there are hundreds of other types of machinery made in this region. Columbus manufactures much mining machinery. As we approach each city, we see smokestacks of the machine shops that make steam shovels, or ditching machines, or road machines, or pumps, or windmills, or laundry machines, or farm fencing, or roofing material, or nails, indeed metal products by the hundred. Here also are those other heavy industries, the making of glass and pottery. There are also furniture factories in many cities on the Lakes, the Ohio, and the land between.

Finer industries. This region is like New England also in making finer metal products—cash registers, in which Dayton leads, and watches.

Opportunity for training. This region has resources for *skill*. The state universities of Ohio, Indiana, Illinois, Michigan, and Wisconsin are all within its boundaries. There are also other universities in Pittsburgh, Cincinnati, Akron, Cleveland, Toledo, Detroit, and Chicago. These institutions train men to become expert at running machinery and designing machinery, and in improving the manufacturing plant and its management.

Cities of New York State Barge Canal region and the Hudson River Valley. The cities on this long waterway have the great advantage of good transportation and a location which gives easy access to markets. The Barge Canal passes by or near Niagara Falls, Lockport, Rochester, Geneva, Auburn, Syracuse, Rome, Corning, Utica, Ilion, Little Falls, Johnstown, Gloversville, Schenectady, Cohoes, and Troy. The channel of the Hudson has recently been deepened, so that Albany has become

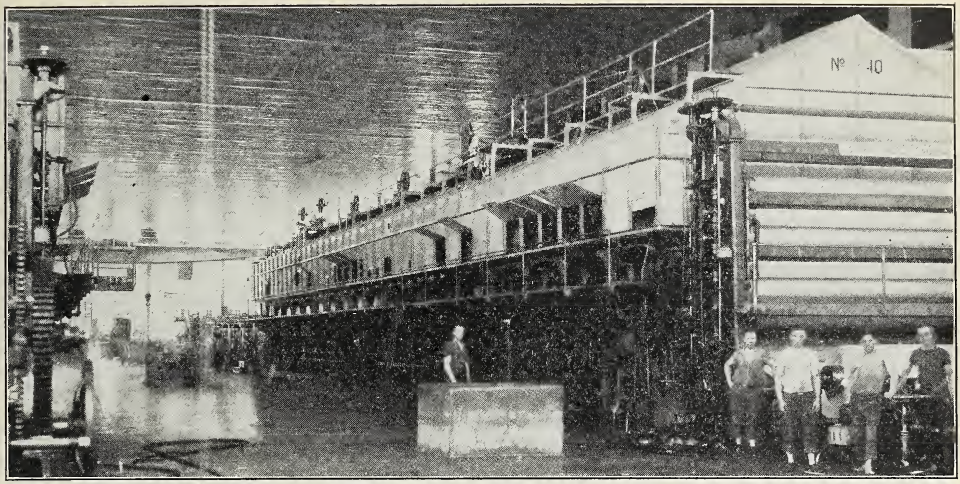


Fig. A. This huge thing at the right is a single machine. It runs night and day. Soupy-looking water flows in at one end. Rolls of paper are wound up at the other. Paper making is a very important industry in the forested country between Wisconsin and Maine, Winnipeg and Newfoundland, with their rivers full of logs.

a seaport which can be reached by 70 per cent of the world's shipping. Some of the finest railroads in the world follow this waterway from the great seaway at New York to the great lakeway at Buffalo. This long line of cities suggests beads on a string—the string of transportation.

Raw material in the harbor of New York or Buffalo can be carried quickly and cheaply to any of these cities on the great transport route between the Lakes and the sea. Forests for lumber and mountains for lumber and water power are near by. More than a century ago the people of these towns began to send their goods to market by way of the Erie Canal. They early began to manufacture. Because the products required much skill, the people became proud of their work and made a living by manufacturing goods that are sent to all parts of the United States and to many foreign countries. Many of the cities manufacture their own special products. Together they make a great variety of products.

Rochester makes clothing and leads the United States in turning out cameras and optical goods. It also makes thermometers, instruments, and filing cases. Rochester makes sirups for soda fountains, because it is near to the fruit industries of the Lake Ontario plain. Syracuse turns out typewriters, chemicals, and machinery. Auburn makes binder twine and farm machinery. Utica makes knit goods; Rome, brass articles; Ilion, typewriters; Herkimer, furniture; Johnstown and Gloversville, gloves; Little Falls, dairy machinery; Schenectady, locomotives and electrical machinery; Cohoes and Amsterdam, textiles; Troy, shirts and collars.

Manufactures in the St. Lawrence Valley. The cities in the Canadian part of the Great Lakes region possess all the materials and natural aids to cheap transport to be found on the American side. The Canadian cities also have another water route to the sea. The Welland Canal, near Buffalo, enables ships to go from Lake Erie to Lake Ontario, a drop of 326 feet. Other canals allow boats to pass around the rapids of the St. Lawrence and out to sea.

The industries of the Canadian side of the Lake region are much like those of the American side. Indeed, many small cities between Detroit and Buffalo have factories that are owned by American companies whose main factories are in the United

Fig. A. New Orleans. In this picture may be seen almost the entire 41 miles of harbor frontage of this great Southern port. Notice how the Mississippi meanders.

States. They make automobiles, machinery, and many other articles for the Canadian market and for export. Toronto and Montreal are large cities. How does their population compare with that of American cities on the Lakes?

This part of Canada is like our own Lake region and our New England region in that it has textile mills. The part north of the St. Lawrence resembles both Wisconsin and New England, because, having wood and water power, it has important pulp and paper mills (Fig. 299-A). Most of the manufacturing in Canada is done in the St. Lawrence Valley and Great Lakes regions. Manufacturing is not yet so important to Canada as to the United States, but Canada has great resources.

THINGS TO DO AND THINK ABOUT

Can you answer these? 1. What advantages have the cities of the lower Lake region?

2. What is meant by *heavy industries* and *light industries?* Name some of each. Tell some conditions that are necessary for each.

3. Where is Canada's chief manufacturing region? In what respects is it similar to the Great Lakes region in the United States?

Manufacturing centers. Make a list of the cities and give the products for which each is noted.

Special report. If the St. Lawrence waterway is built so that ocean steamers can enter Lake Erie, how will it affect the region just studied?

UNIT 4—MANUFACTURING IN CITIES ON, AND WEST OF, THE MISSISSIPPI

PROSPECTS. Compare the future of manufacturing in an inland city west of the Mississippi River with that in a city in each of two other regions you have studied.

Cities on the Mississippi. Four large cities stand on the banks of the Mississippi. Like the cities in the plains to the west they are not in a manufacturing region. However, they have important manufacturing industries.

New Orleans has sugar refineries, oil refineries, rice mills, fertilizer factories, and many industries which supply the home market, but New Orleans is primarily a distributing center and a port with large exports of cotton, lumber, and many other articles.

At the other end of navigation on the Mississippi, St. Paul and Minneapolis produce great quantities of flour, packing-house products, and butter. Sometimes farms as far away as Nebraska send their products to these city plants. These cities, like New Orleans, are chiefly distributing centers.

St. Louis, close to the center of population of the United States, has eighteen trunk-line railroads which have helped to make it a great wholesale center from which many things are shipped to the small towns of the Southwest and even to Mexico. The railroads have also helped to make St. Louis a great manufacturing center. If you will recall the facts you have learned about the chief industries of the United States, and remember that St. Louis is on the navigable Mississippi not far from the navigable Ohio, you will see that with few exceptions all important raw materials can be assembled there cheaply. Therefore St. Louis has come to be a manufacturing center for a

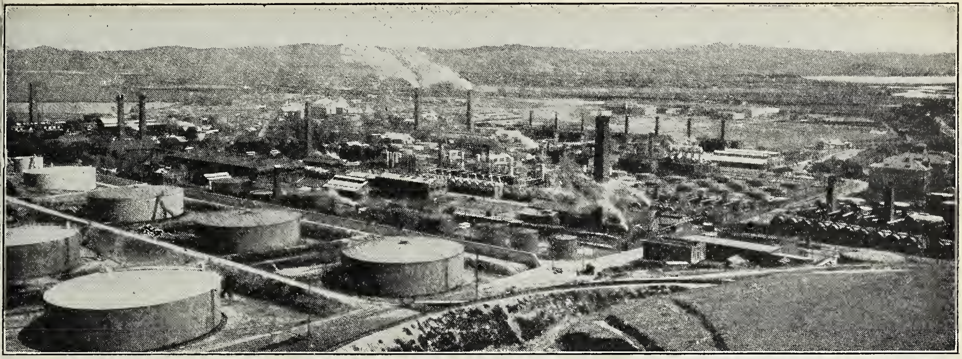


Fig. A. One of California's great manufacturing industries is the refining of oil. Refineries, such as the one in the picture, are located in the Bay cities (cities about San Francisco Bay) and in Southern California.

great variety of products—packing-house products, clothing, shoes, stoves and ranges, railway cars, paints, and many, many others.

Manufactures of the cities beyond the Mississippi. Dallas, Fort Worth, Omaha, Des Moines, and St. Joseph have packing plants that ship to distant markets, and many factories that make products for use in and near the city. Compare the transportation problem of some of these cities with that of some cities farther east.

Winnipeg, the commercial metropolis of the Canadian prairie provinces (spring-wheat region) is so much like the other cities west of the Mississippi that we need merely say "There is another one."

The Pacific coast. The Pacific coast can scarcely be called a manufacturing *region*, but it has four important and growing manufacturing *centers:* Los Angeles and vicinity; San Francisco, Oakland, and other towns on San Francisco Bay; the Puget Sound region with Seattle and Tacoma; and the Willamette Valley with Portland.

The Pacific coast lacks abundant coal; no iron is made, but the oil field of southern California gives a cheap and efficient source of power. There is much water power in the Sierra Nevada, and more in the Cascades near the cities on Puget Sound and the Columbia River. This region is really the water-power center of the United States. Such power is a *great* resource.

For a long time manufacturing on the Pacific coast was limited chiefly to local raw materials, wood, fish, fruit, wheat, and to products for the home market. The opening of the Panama Canal in 1914 provided the Pacific coast with a cheap way of getting iron and steel from the furnaces of the East. The automobile-tire industry of Los Angeles is the first large industry of the Pacific coast that depends on imported raw material, supplies the home market, and produces large quantities for shipment to other localities. This industry marks a forward step for the Pacific coast manufactures.

THINGS TO DO AND QUESTIONS TO ANSWER

Make a short talk. About: 1. St. Louis as a wholesale center.

2. Power resources on the Pacific coast.

3. The Panama Canal and the Pacific states.

4. A city on the Mississippi.

5. A city west of the Mississippi.

Some industrial centers. Compare Denver, Colorado, with Des Moines, Winnipeg, Detroit, St. Louis, Cleveland, as to raw materials, power, and markets.

Scattered industries. 1. Make a list of industries that every large city must have. Explain why.

2. Name some industries that are not necessary to every city.

3. Name some industries near your school that produce products for home consumption; for wider consumption.

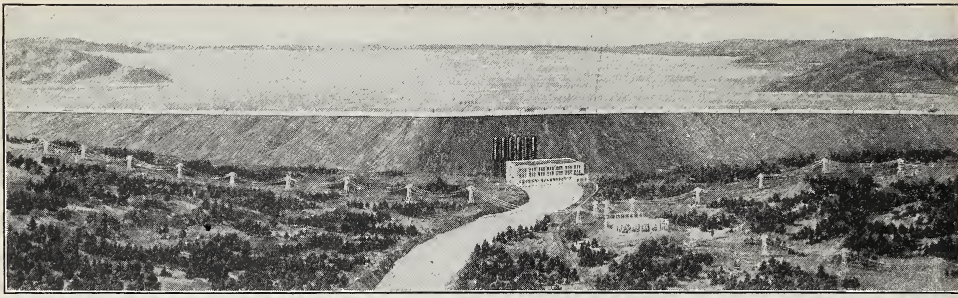


Fig. A. Water power, one of the chief reasons why our Southern States are becoming centers of manufacturing. This station is near Columbia, South Carolina. See the dam, the man-made lake, the power station, the transmission lines. This station will develop 140,000 K. W. (kilowatts) of electrical energy. This represents the pulling power of approximately 185,000 draft horses, and the power plant can work day and night.

Fig. B. Water power, old style. An overshot water wheel of the kind which supplied power for the early gristmill and sawmill.

UNIT 5—MANUFACTURES OF OUR SOUTHEASTERN STATES

EXPLAINING INDUSTRY. Discover why the region between Richmond and Birmingham manufactures a smaller variety of articles for shipment to distant places than does the region between New York and Buffalo.

Rapid growth of manufactures. The most recent great change in manufacturing in the United States has been the rise of manufacturing in the Southern States. Most of the plants are located in the region that begins at Richmond, Virginia, extends along the eastern slopes of the Appalachians to Atlanta, Georgia, and on through northern Alabama into southern Tennessee. Most of this region is on the area colored yellow on Plate I. What is its elevation?

We find a hundred industries in St. Louis and in the cities along the New York Barge Canal, but only four main industries in the Southern manufacturing region—tobacco, cotton textiles, furniture, iron and steel.

Power is carried by wire from streams fed by mountain rains. Factories are often located in small towns scattered over a wide area. The largest cities are Atlanta and Birmingham. Others are Columbia and Greenville in South Carolina; Charlotte, High Point, Greensboro, Winston-Salem, and Durham in North Carolina; Danville, Roanoke, Lynchburg, and Richmond in Virginia; Chattanooga in Tennessee; and Birmingham in Alabama.

Resources of the industrial area. The mild climate makes the cost of living low (page 249). The heavy rainfall of the region and the adjacent mountains is well distributed throughout the year and makes abundant water power. One great superpower system connects hundreds of towns and cities in several states. It is fed partly by water-power plants and partly by steam plants. The United States Government's hydroelectric power plant at Muscle Shoals, Alabama, is one of the greatest in the world. At present there are not enough industries to use it fully, but the Tennessee Valley Authority has plans for its future use.

Appalachian coal is not far distant. The labor supply has been abundant. Most of the farms are what are called one-crop farms. A farmer grows only tobacco or cotton to sell. He may grow corn for the work

animals. Perhaps he has a garden; perhaps not. If he can get enough money from selling cotton or tobacco, he often buys everything the family uses. During much of the year there is no work that farmers need to do; the young people then work in the factories. Another source of labor for the factories is found in the mountains. The little, rough, hilly mountain farm yields slim support for the customary large family. In order to earn a little money, some of the family seek work in the factory town or the entire family moves to town.

Tobacco manufacture. One of the largest tobacco-growing regions in the United States is in central North Carolina and the near-by parts of Virginia.

Unmanufactured tobacco is bulky stuff. By having farm and factory near together, long hauling is avoided. In Winston-Salem, Durham, and Richmond millions of dollars' worth of tobacco is manufactured into cigarettes, smoking tobacco, chewing tobacco, snuff, and by-products.

The textile industry. The textile industry is scattered throughout the entire length of the region. In driving through this region, from Virginia to Alabama, one sees many, many textile mills. These mills make many different kinds of cloth and the quality is improving from year to year. You learned of this industrial development in an earlier chapter (page 249).

Furniture manufacturing. Oak from the Southern Appalachian Mountains is excellent material for making furniture. Other useful woods are found, such as hard pine from the long-leaf pine districts of the sandy plains not far away, and gum from the Southern swamps. North Carolina has advanced rapidly in the manufacture of furniture.

Iron-ore smelting. You have already studied about the iron of Birmingham (page 215). The barges on the Warrior River give water transport to ship side at Mobile, and through canals and lagoons to New Orleans.

North Carolina leads. North Carolina, having a leadership of the South in textiles, furniture, and tobacco, is far ahead of any other Southern State in value of manufactures.

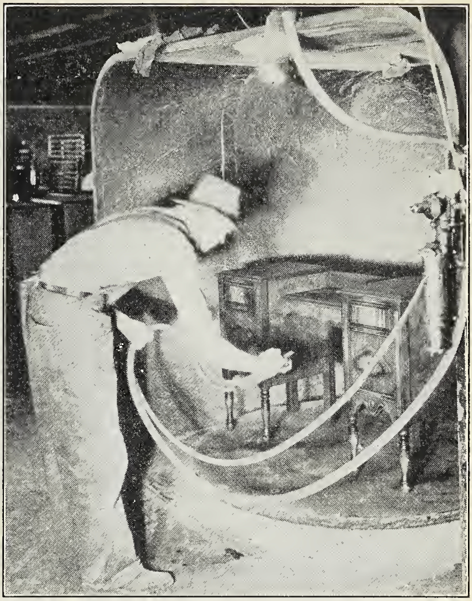


Fig. A. Spraying paint on new furniture in a North Carolina factory. This is one of the many new ways by which mass production makes things cheaply.

THINGS TO DO AND QUESTIONS TO ANSWER

How well did you read? 1. Why have not large cities grown up in the Southern section as they have on the Great Lakes?

2. What resources has this industrial region?

3. What four main industries has the Southern manufacturing region?

4. Name some cities and their special products.

5. What Southern State leads in the value of manufactured products?

A new national project. What plans have been made for the development of manufacturing in the Tennessee Valley? For information write to Tennessee Valley Authority, Knoxville, Tenn.

Something to find out and to think about. 1. What is Mr. Henry Ford's idea about the same man working on a farm and in a factory? Does the manufacturing in the country or small town in the South have the same advantage? (See Figure 249-A.)

2. Compare the cost of living in the place shown in Figure 249-A and in a great city where there are only pavements and small parks.

Fig. A. These small bits of precious earth show how the German factory worker appreciates a garden and has one, if he possibly can. The little gardens within this fence may belong to several different families.

UNIT 6—MANUFACTURING IN THE RHINE VALLEY, THE LOW COUNTRIES, AND FRANCE

> Geographic Comparison. Discover how this region resembles other regions we have studied, and how it differs from them.

Other industrial pupils of Great Britain. The Industrial Revolution began in Great Britain (page 246) and, as you know, crossed the Atlantic to make the greatest manufacturing region of North America. It also crossed the narrow seas to Holland, Belgium, the north of France, and the Rhine Valley of Germany. The greatest manufacturing region of the continent of Europe has developed there.

This European region has excellent resources. The climate aids in keeping the people healthy and strong. The regular rainfall supports good crops. For centuries this region was famous for the fine cloth made by its weavers. For centuries it has had a heavy population of farmers living in the villages and cultivating their small farms near by. Even now tens of thousands of factory workers live in villages where they have a garden, fruit trees, poultry, rabbits, and perhaps a little farm land. The wages are low, which gives these countries an advantage in being able to sell goods cheaply in foreign markets.

Now that this has become a land of factories as well as of farms, I see as I look across the well-tilled fields, the shade trees that shelter a village, the church spire standing above the trees, and also a *factory smokestack*. As the steamer takes me up the beautiful Rhine, I see railroads on each bank and a succession of towns, with smokestacks always in sight.

The coal field that underlies the north of France, Belgium, and near-by parts of Germany gives power for a hundred industries and coal tar for chemicals. The Rhine is a great waterway, rendering a service like that of the Great Lakes and the Ohio River. The Netherlands has 2000 miles of canal and 2000 miles of railroad. Canals connect the harbor of Anvers with Paris, the Rhine, Bruxelles, and most of the cities of Belgium and the Netherlands. On excellent railroad beds express trains run from Amsterdam and Rotterdam to Anvers and on to Paris; from Anvers to Köln and Berlin; from Paris to Berlin. These trains all pass through this region.

Like Pittsburgh and like Birmingham. Lorraine, the northeast corner of France next the Rhine, has the greatest

iron-ore field of Europe. Much of the ore is used in Essen and the other near-by iron towns of the German Rhineland where there is a good coal supply. Spanish and Swedish iron ores for mixing with local ore can be brought by boat up the Rhine from Rotterdam and Anvers. These facts help to explain the reason why Germany and France have both passed the United Kingdom in iron and steel manufacture. Belgium, which also produces some of the coal, is another great manufacturer of iron and steel. The World War gave back to France large iron deposits in Lorraine.

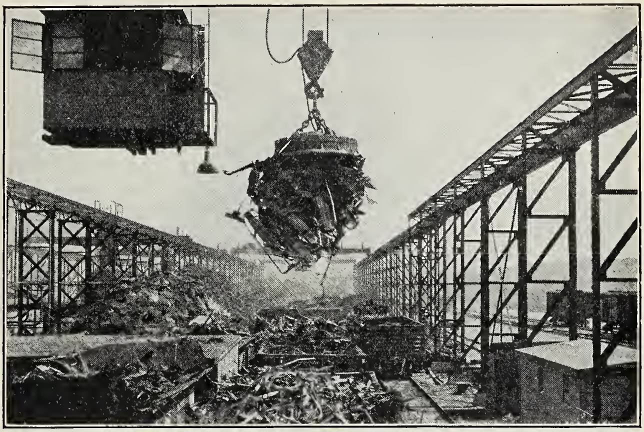


Fig. A. Pieces of entangling forms of scrap iron are very mean things to handle, but the electromagnet does it perfectly. A man in the cage at upper left turns on the current, which makes the iron a magnet. It picks up a few tons of iron, carries it, and drops it when the current is turned off.

Not only does this region export iron and steel, but it also exports machinery. In this respect, however, the Europeans are far behind the United States, because Germany, France, and Belgium have not perfected standardization and interchangeable parts as extensively as we have done. We have also exceeded them in inventing more types of machinery.

Pottery, chemicals, and beet sugar are other important products of this region.

Iron and steel is, after agriculture, the chief industry of little Luxembourg, which has both coal and iron ore.

Belgium, with deposits of limestone and glass sand, adds to her iron and steel industry important productions of window glass, plate glass, and cement. These products she exports to many countries.

Another New England in manufacturing. In this part of western Europe many textiles are manufactured. Lille in northern France, with cottons and woolens, is the greatest single textile center, but Aachen, just across the Belgian boundary in Germany, is the center of the German wool industry. The German linen industry is near by. Belgium and the Netherlands manufacture cotton, wool, and linen, and Bruxelles, with many industries, is especially famous for its lace. The Netherlands has long been an importer of coal and iron, so her industries are not so heavy as those of Belgium.

Amsterdam and Anvers are important diamond-cutting centers. This is an industry which we might almost say has one qualification—that of highly skilled labor.

Manufactures of Paris. Paris, the third largest city of the world, uses much coal imported from Wales. Like London and New York, Paris has many industries, but especially does it make products representing artistic design and good taste. Paris is noted for its manufacture of fine clothing, lace, gloves, leather ware, perfumery, artificial flowers, all of which are exported to the United States, United Kingdom, and other countries.

Other French manufactures. France has a few other scattered manufacturing centers: silk at Lyon; pottery and porcelain at Limoges; iron and steel goods near the small coal fields of St. Etienne and Creuzot.

THINGS TO DO AND THINK ABOUT

Can you answer these? 1. What resources has this European region for manufacturing?

2. What did this chapter tell you about transportation in this region?

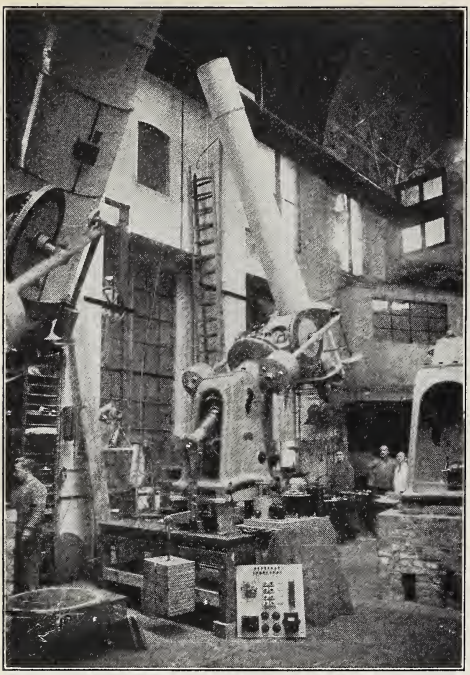


Fig. A. A telescope being built in a German optical works for use in Philadelphia. This is one of many industries resulting from the many technical and trade schools that the German Government has supported for many years.

3. What facts help to explain Germany's growth as a steel manufacturer?

4. What did this unit tell you about textile manufactures?

5. Where does Paris secure its coal? For what products is the city noted? Is it well situated for *heavy* industries?

6. What can you tell about Belgian manufactures?

Some thinking. 1. Read the sections on forestry, chemicals, potash. What do they tell you about Germany? France?

2. Find out what the German Government has done in recent years to aid industry.

3. Do any of the pictures in this book show German thrift?

Filling in the blanks. Make up ten sentences, each telling something about what you have learned in this unit. Leave two words missing from each sentence. Exchange papers. Could you fill in the blanks in your neighbor's paper?

France. 1. From a review of this chapter discuss why France has not developed large industries.

2. What does she manufacture?

3. Why did she choose these products?

UNIT 7—MANUFACTURING REGIONS OF CENTRAL EUROPE AND SCANDINAVIA

A WISE POLICY? Should the countries mentioned in this unit try to develop industries to supply all of their own needs?

Saxony, Berlin, and Hamburg. The great manufacturing region of the Rhine Valley and the Low Countries that we have just studied is half surrounded by a ring of smaller manufacturing regions.

The German district of Saxony, with Dresden, Leipzig, and Chemnitz as its chief cities, has a coal field and manufactures of iron and porcelain, but especially of textiles. In the neighboring mountain forests some of the people have three jobs: in spring and summer they farm little tracts of land; in winter they chop timber; and in bad weather they carve toys and other small objects from wood.

Berlin, the capital of Germany, is one of the great cities of the world, and in the same way as New York and London, it manufactures some of almost everything, but has no great specialty.

Steamship lines connect the great city of Hamburg with every continent. Hamburg manufacturers show great skill in making and packing goods in many different ways in order to meet the transportation problems of their customers. The Germans make some grand pianos that they ship in parts. The parts are of such a size that they can be balanced across the backs of pack mules when climbing the Andes or be put on pack horses in South Africa. The Germans make some pianos in such a way as to stand the terrific pounding of travel in a springless oxcart over the ruts and bumps of Central American mountain roads.

The Silesian coal field. Silesia has one of the fine coal fields of Europe at the place where Germany, Czechoslovakia, and Poland meet. Before the World War the coal belonged to Germany, but now it is divided among the three countries. The Silesian coal field is a busy land, with iron,

steel, cement, and machinery as prominent features. It is a region much troubled by quarrels and tariff disturbances of trade among these three countries.

Silesian coal runs the power plants that make Warszawa and Lodz centers for the manufacture of textiles and leather.

Czechoslovakia. Eastern Czechoslovakia is a farming region, but the western part, Bohemia, is in many respects like Belgium or England. It has coal in the central part as well as in the Silesian corner, and its people are highly skilled in manufacture. Bohemia has iron ore, which goes to foreign lands in the form of engines, electrical appliances, and machinery for manufacturing beet sugar and many other things. Bohemian coal turns the wheels of silk and cotton mills, supports cement factories and the plants that make the famous Bohemian glass and pottery.

Czechoslovakia differs from Belgium and England in having mountain forests, which explain her exports of pulp and paper.

Switzerland, Austria, and the Alps. Only a small part of Switzerland is suitable for growing food; therefore the Swiss import much food. The country has no coal, iron, oil, copper, cotton, or silk, and but little wool. Most of her area is mountainous. The perpetual snow and ice upon the mountain tops are very valuable, because the melted snow makes waterfalls from which power goes by electric wires into almost every village and to almost every house. This helps Switzerland to support herself by fine manufactures. She buys bales of American cotton and Japanese silk which she makes into ribbon, lace, and other fine goods for export. Switzerland imports a little metal, with which her very skilful and intelligent people make watches, instruments, and fine machinery.

Austria is almost as mountainous as Switzerland, but she has more forest and also some coal. Austria has many manufactures for home supply, but exports chiefly wood products, hats, and clothing for women, and some machinery. Her industries are not so fine or specialized as those of Switzerland.

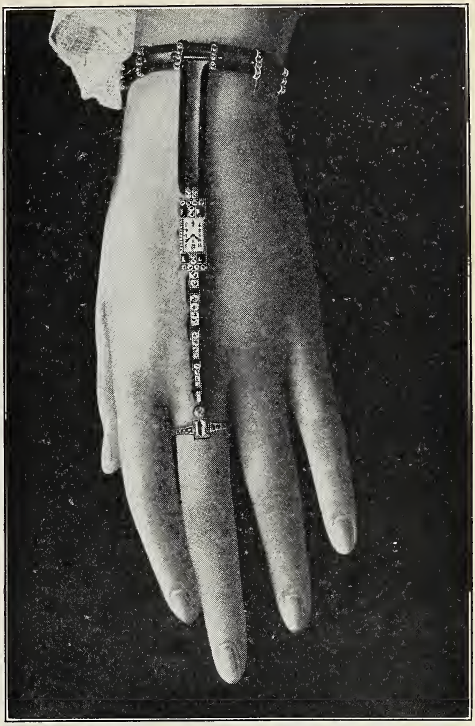


Fig. A. The Swiss are such skilful workers that their watches sometimes become real jewelry.

Wood and the two-job man of the Baltic countries. In the countries on both sides of the Baltic Sea—Poland, Lithuania, Latvia, Estonia, Finland, and Sweden—are many men who are farmers in summer and wood choppers in winter. In all these countries wood is a chief raw material of manufacture and usually the most important export. Wood is exported in many forms, from matches to saw logs, including planks, boards, mine props, shingles, and pulp wood. Wood is also ground to pulp and then made into paper products.

These Baltic countries have sawmills and paper mills scattered along the coasts and rivers in places where it is most convenient to get logs together by floating them downstream (Fig. 308-A). Finland, the coldest and roughest part of this region, has

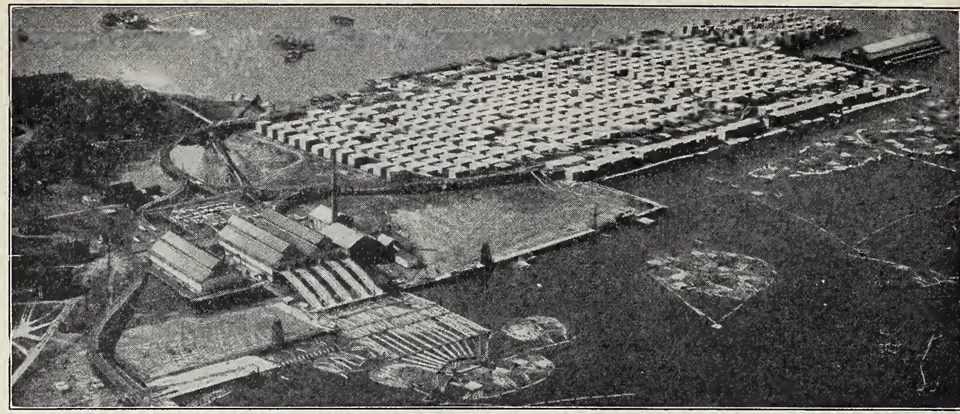


Fig. A. The east coast of Sweden, latitude 63° 48′. Find log-storage pond, the five inclines up which logs are dragged into the sawmill, lumber piles, railroad tracks, and harbor. Find places in North America having the same latitude. What can you tell about the climate and industries of the American places?

the most complete dependence upon wood. Sweden is the greatest match manufacturer in the world.

The fine manufactures of Sweden and Norway. In addition to much manufacturing that utilizes wood, Sweden still makes some iron by the old-fashioned method of using charcoal. It is the best iron in the world. With it Sweden makes steel and turns that into engines, pumps, dairy machinery, and other fine apparatus.

The great water power of the high Scandinavian mountains enables Norway, like Niagara Falls, to be a manufacturer of aluminum and nitrates.

THINGS TO DO AND THINK ABOUT

Little sketches. 1. Select two countries, tell briefly their resources for manufacturing, at least one important industry in each, and why it suits the condition of that country.

2. Pick out countries that are alike in manufactures. Explain countries that are unlike.

3. Compare each country mentioned in this unit with some other country.

4. Compare the freight cost of Belgian and Swiss exports.

Complete the following sentences. 1. Berlin manufactures ———.

2. Bohemia is like ——— or ——— because ———.

3. Sweden makes iron by using ———.

4. Norway, like Niagara Falls, manufactures ———.

5. Switzerland has water power because ———.

UNIT 8—MANUFACTURES OF THE LOWER DANUBE AND RUSSIA

A COMPARISON. Find the resemblances and differences between the manufactures and cities of this region and the region between the Mississippi River and the Rocky Mountains.

Cities of the Danube. In the Danube Valley east of Austria are three national capitals—Budapest, Beograd, and Bucuresti. The cities are the capitals of countries that differ greatly from the United Kingdom, Belgium, or Germany. These countries more nearly resemble some of our Western States, being exporters of farm products and having few manufactures for home use. The plants—most of which are in the capital cities—are mainly food and tobacco factories, clothing factories, leather factories, and a few plants for textiles, woodworking, metal working or repair. These countries, like the states beyond the Mississippi, are all importers of textiles and nearly every other kind of manufacture.

The Hungarians have recently built large cotton mills, because Hungary by tariffs has shut herself off from the cotton mills of Austria and Czechoslovakia. Mills have since stood idle in Austria and Czechoslovakia because the new mills in Budapest supply some needs of the Hungarians.

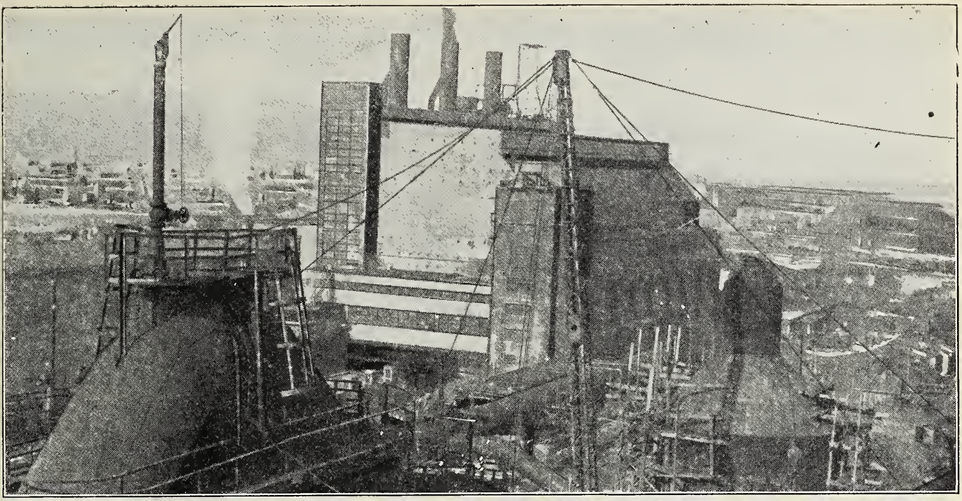


Fig. A. A bit of the New Russia. A partly completed plant for making coke, smelting ore, and making electricity in the new city of Kuznetstroi. The Russians are trying mass production.

Russia's plan. Before the World War Russia was almost as wholly agricultural as are the prairie provinces of Canada or the states of Nebraska or Dakota. Most of the large population of farmers lived in villages, had very small tracts of land, and therefore had little to do for a large part of the year. Recently the Russian Government (U. S. S. R.) started in to remake the nation. Instead of being a nation of farmers only, the Russians plan to supply themselves with most manufactures and perhaps make some for export. They have planned new industrial cities, which they have begun to build on a scale grander than such cities were ever planned before. Many Russians have gone hungry because the government had to send exports, including food products, to pay for the machinery needed for starting the new industries in the factories which the government owned. Russia wants tractors to aid in producing cheap wheat with which to feed the people in her growing cities. She wants electric motors to drive the factory machines. Russia wants airplanes to fly over the earth. She hopes soon to be able to build all of the machinery that is needed by her vast population in her vast country.

The Russians have become infatuated with the idea of mass production. Henry Ford, with his assembly line and vast output, is a great hero in Russia. The Russians have built factories of great size (Fig. 309-A). At Dnepropetrovsk on the Don they built the largest masonry dam in the world; its output of electric power is enormous. They have planned groups of industries that will work together, such as coke plants with blast furnaces, steel mills, power plants, and machine shops alongside.

The centers of industry. There are two coal fields south of Moskva—Tula, a short distance away, and Donets, the larger one, just north of the Sea of Azov. Located on each of these coal fields are iron works and many new industries. The old city of Leningrad, Russia's one seaport on Baltic waters, has large airplane factories, while Moskva, the capital, like most other large capitals, has many different industries.

Magnitogorsk, on the upper Ural, one of the new cities, is laid out on a large scale with great iron and steel plants. There is a large farm-machinery plant at Rostov, a tractor plant at Samara, and a combine-harvester plant at Saratov.

Something to watch. It will be in-

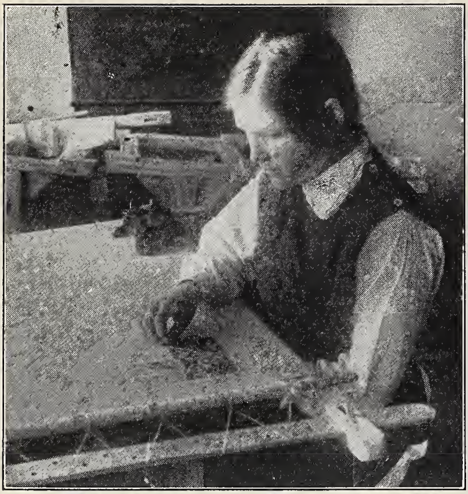


Fig. A. Another part of the New Russia—a pupil in a lace-making school for women who live on farms. When she finishes her course, she joins a coöperative association which sells the output of all its members.

teresting to read the newspapers from month to month and see how Russia succeeds with her great plans. Nothing like it has ever been tried before. Americans and other foreigners are in Russia to teach the people how to make and use machinery. The Russians are more accustomed to using a pair of horses or oxen and an old creaking wagon than to operating a machine. If Russia succeeds, it will be a great triumph for education. The government has begun to educate both young and old in country and city with a speed and intensity such as have never before been applied to education.

THINGS TO DO AND QUESTIONS TO ANSWER

Comparisons. 1. Find points of likeness or unlikeness between the lower Danube Valley, southwestern Russia, and parts of North America. To do this examine the two continents carefully on Figures 2-A, 20-A, 22-A, 23-A, 26-A, 27-A, and 68-A.

2. Is there any important difference in ease of transport and market between Rumania and Nebraska?

A short talk. Tell about: 1. Mass production in America and in Russia.

2. The Russian Plan.

UNIT 9—THE MEDITERRANEAN PURCHASERS OF POWER

A FOREIGN ADVISER. What policy would you recommend to the Greek people and government with regard to encouraging manufacturing in that country?

A double handicap. The countries along the Mediterranean Sea—Spain, Italy, Greece, Turkey, Palestine, Tunisia, Algeria, Morocco—are cursed by the absence of coal. Every day in the year British coal ships are unloading in some Mediterranean port and coal trains from Germany are rumbling through the Alpine tunnels.

How does the climate of these countries affect water-power resources (Fig. 2-A)? A stream to be depended upon as a source for water power needs to flow twelve months in the year. Unfortunately, there are no important snow fields on the mountains of these countries, except on the Alps and the Pyrenees. With the double handicap of scarcity in coal and water, the Mediterranean countries lag in manufacturing.

Fine ancient industry. Spain and Italy long have been famous for the splendid handwork of their spinners, weavers, and dyers, and for fine objects made by workers in leather, wood, and metal. Today this skill still exists in Italy's exports of art glass, beads, lace, and fine woodwork. But in the machine age the manufacturers of these countries are in trouble, because they have to buy coal in foreign lands. This makes the water power of the Alps and Pyrenees mountains very important in the production of such manufactures as Spain and Italy can have.

Spain. Barcelona is the chief manufacturing center of Spain. It has electric power, brought on wires from hydroelectric plants fed by Pyrenean snows. Some large cement dams in these rivers were built by American engineers and financed with money of French and Belgian stockholders. Barcelona has manufactures of textiles, glass, leather, paper, and cork (a local raw material), but Spain is chiefly an exporter

of raw materials and an importer of manufactured goods.

Italy. Examine this list of Italian imports: coal, petroleum, iron, copper, and lumber; wool and cotton; wheat and corn. Is Italy rich or poor in resources for manufacturing?

The plain of Lombardy. The Po Valley or the plain of Lombardy is much the best part of Italy. It receives enough summer rain for some summer crops, and gets enough water from the Alpine streams for the irrigation of fields of rice, alfalfa, and other crops. This fertile plain is thickly studded with cities and villages. It is crossed and recrossed by electric-power lines from the Alps. For these reasons the Po Valley has become the chief manufacturing region of Italy. While Milano and Torino are the chief centers, there are many factories built in the small country towns. As is the case in Belgium, the Netherlands, and the Rhineland, the worker has some land upon which he and his family grow much food for their own use.

Italy exports some cotton, silk, woolen and leather goods, straw hats, chemicals, glass, lace, woodwork, automobiles, tires, and boats. In 1929 she imported forty million dollars' worth of cottons, woolens, and silks, and exported four times as much.

Turkey. For a long time, wars, bad government, oppressive taxation, and lack of schools made people fear to invest money in Turkey. Not long ago Istanbul had many bazaars with hand workers, but in that large city there was not a single smokestack. Since 1923 great reforms have been started in Turkey. In 1934 the government announced a plan to encourage manufactures, but at that time Turkey could not manufacture even a bottle.

Palestine. The starting of a hydroelectric plant on the river Jordan in 1933 marked the beginning of modern manufacturing in Palestine. There are two lakes on the upper course of the Jordan River. What influence may they have on the power plant?

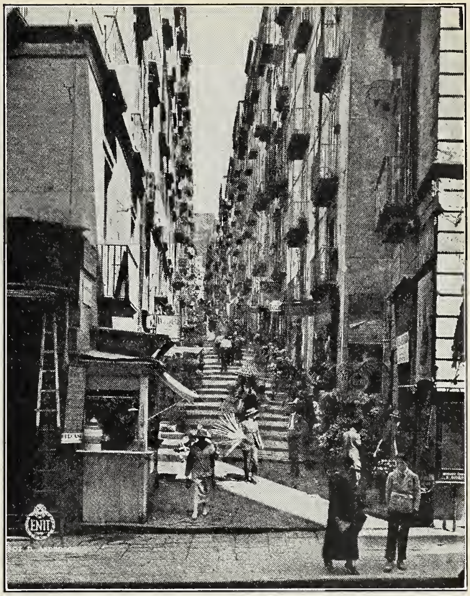


Fig. A. Italy is a country of few resources and crowded with people. There are many streets, like this one in Napoli (Naples)—so narrow that vehicles cannot go up and down. The high buildings are without elevators.

THINGS TO DO AND QUESTIONS TO ANSWER

Problems. 1. As to future of manufacturing, compare Italy with United Kingdom, Norway, Switzerland, Ohio.

2. Pick out a country in Europe with which Italy is likely to compete in manufactures. Why? One with which she is likely not to compete.

3. What is your answer to the question at the opening of this unit?

4. Spain has exports of copper, quicksilver, and iron ore, and, except for coal, is the richest mineral country in Europe. Why isn't she a great manufacturing country?

A problem for investigation. Copy and fill in the following chart. The *Commerce Yearbook* and the *Statesman's Yearbook* will aid.

Country	Chief Industries	Exports	Imports
Spain			
Italy			
Greece			
Algeria			
Tunisia			
Turkey			

UNIT 10—MANUFACTURING IN EASTERN AND SOUTHERN ASIA

> CHINA'S PROBLEM. From what you have learned about manufacturing regions and industries, what policy about manufacturing would you recommend for China?

Where are Asia's people? Most of Asia is too dry or too cold for farming. Most of this, the largest, continent is therefore a land where nomads follow flocks across wide spaces (page 33), with here and there oasis cities like Damas, Tehran, and Tashkent situated at places where some river brings snow water from the high mountains (page 35). What can be said about such a city as a place to manufacture for the home market (Fig. 288-A)? for the distant market?

There are strips of farm land and towns along the Trans-Siberian Railway (Plate XVIII), along the coasts of the Mediterranean Sea, the Black Sea, and the southern end of the Caspian Sea, but most of the people of Asia are found in the monsoon lands of southeastern Asia—India, China, and Japan, and the countries between China and India.

Manufactures of the monsoon lands. India, China, and Japan, with their heavy summer rain, their ancient agriculture of rice and millet, beans and vegetables have supported for ages cities where men engage in fine handicrafts (page 269). In each of these countries are thousands of villages whose artisans make by hand most of the articles used by the inhabitants. The story of the tile maker (page 270) is typical of the industry that has prevailed for two or three thousand years in the countries of southeastern Asia. These countries now support about half the human race, and most of their manufacturing is still done in the old, old way, although machinery from Europe and America is steadily making changes.

Gandhi's complaint. Southeastern Asia is still chiefly a land of village farmers, whose farm work leaves them several idle months. Mahatma Gandhi, a Hindu who has labored long for the betterment of his people, complains that European factories bringing in cheap goods make it impossible for the village worker to compete at spinning and weaving. Accordingly the villager sits and does nothing, instead of following his ancient craft, and is therefore poorer than ever. Mr. Gandhi has urged the people to get out the old hand spinners and hand looms and to take up again spinning and weaving cotton cloth. To buy cheap cloth is not easy, because the farmer cannot raise enough produce to furnish food and the small sum of money necessary to pay for the cloth.

We have studied already about India's export of manufactures (pages 218, 250, and 288). Where are they?

Manufactures of China. In Shanghai certain tracts of land have been leased to foreign governments to own and to rule. Being governed by Europeans, they are almost like a part of Europe. They greatly resemble true European colonies. Several thousand Europeans and Americans live on the leased lands. The many factories are built in European and American style, sometimes by European, American, or Japanese owners. The factories employ Chinese workmen to build ships, make cloth, and many other things. If you walk across a street, you are in the native part of the city. There, as in hundreds of other Chinese cities, you see many streets lined with little shops where men and women, boys and girls, make things by hand as these people have worked for centuries.

At Hankow is a modern iron works. Because of civil wars, it has produced but little of late, and like the few other modern factories of China, it can only be considered an oasis of western industry in a sea of handicraft and domestic industry.

Japan. In Japan the ancient hand industry still continues, but as in Russia, the government has made great efforts to modernize industry. A beginning was made more than fifty years ago when young

men were sent to Europe and America to study science. The Japanese employed experts from Europe and America to go to Japan and teach Western methods and learning. The government has lent money to manufacturers who started new industries, and to steamship lines that would carry export goods to foreign lands.

Some parts of Japanese cities look like the old Japan, but other parts look more like American and European cities, with trolley cars and electric lights, tall buildings with steel skeletons, and factories equipped with modern machinery of European model. The cities of Kobe and Osaka may be likened to Liverpool and Manchester: one primarily a port, the other primarily a factory center. Tokyo has many Europeanized industries, as have many small towns in the southern third of Japan.

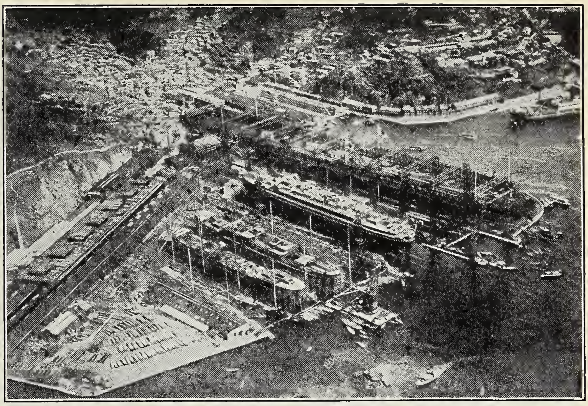


Fig. A. The New Japan—a shipyard, European style, at Nagasaki. The Old Japan—houses crowded close together and terraces of the intensive agriculture.

Japan's resources. Japan, like Italy, is poor in natural resources. Most of her land is too steep for tillage. She has a very dense population, almost no cotton, wool, or hides, no oil, potash, or phosphate, and but little iron or coal. But Japan is better off than Italy for water power. I remember going down a Japanese river. I passed a dam and followed the pipe that carried water from the dam to a power plant a mile downstream. Immediately at the base of this power plant was another dam gathering the water of the stream for the next power plant still farther down.

Sixty per cent of Japan's electric energy is made by water, but unfortunately the greatest need for current comes in midwinter with its long, dark days. When does Japan's heavier rain come? Now that she has possession of Manchoukuo (Manchuria) and its coal and iron fields, her industries will have the aid of these basic materials.

Japan's greatest manufacturing development thus far has been in textiles. Can you explain why this is true (pages 250 and 257)? Japan is also steadily increasing the number of the industries in which she is copying Western methods. Japan is already the greatest manufacturing country outside of Europe and North America.

THINGS TO DO AND THINK ABOUT

Explain. 1. The difference between the water-power value of streams in Japan and Italy.

2. The influence of the concessions (leased land) in Chinese cities on manufacturing.

3. The influence of Chinese civil wars on manufacturing.

4. Some industries that China may soon have and some that she is not likely to have soon.

5. The Japanese industrial plan.

6. Mahatma Gandhi's idea.

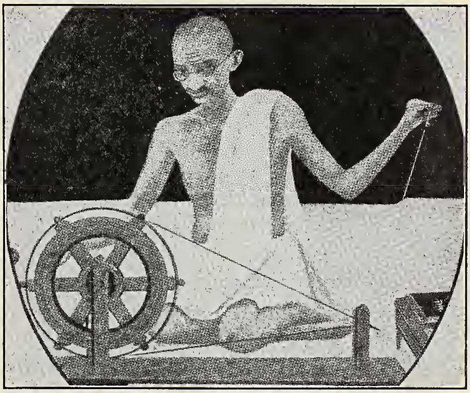


Fig. B. Mahatma Gandhi and the *charkha* or spinning wheel.

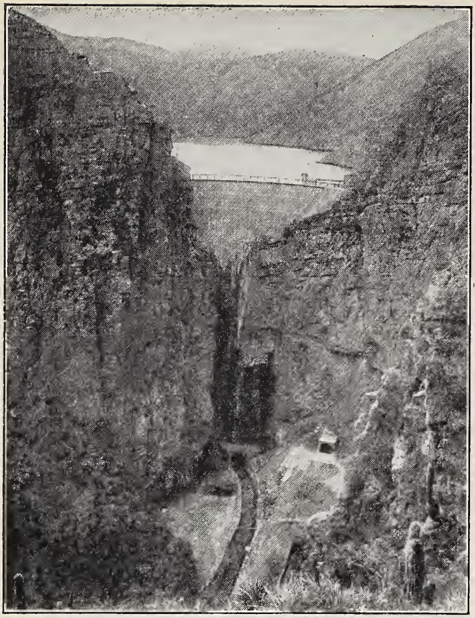


Fig. A. Part of a mining enterprise. This dam, built in a defile in the mountains of Bolivia, makes power to work a copper mine miles away.

UNIT 11—THE MANUFACTURES OF THE SOUTHERN HEMISPHERE

> Policy for the Southern Hemisphere. How much manufacturing should the Southern Hemisphere attempt to do?

The raw-material stage. You can scarcely look around you without seeing something that has come from the Southern Hemisphere—the wool in your clothing, the leather in your shoes, tanned in part by quebracho—but you will probably search far to find many packages of finished products from the Southern Hemisphere. I saw one the other day—canned corned beef made in Brazil.

The industries of the machine age are very new to the lands of the Southern Hemisphere. Australia was settled by Europeans more than a hundred fifty years after New England. Argentina was only a cattle and sheep ranch long after Illinois had become a great grain-growing state. The settled lands of the Southern Hemisphere have scanty populations. They are far away from Europe and the United States. They are poor in coal. Nature does not seem to have made much coal in the tropics or in the low latitudes in which nearly all land of the Southern Hemisphere lies. There is some coal near Sydney, Australia; some in Natal; a little in Chile; none worth mentioning in Argentina, Paraguay, Uruguay, or Brazil. Upon the whole, the part of the Southern Hemisphere where most of the people are, is strangely poor in power resources.

Industries of big cities. Recently settled lands, unlike New England and the industrial districts of our own South, seem to develop one or two big cities and no others nearly as large. Thus, in the Australian states we find Sydney, Melbourne, Adelaide, and Brisbane. In South America we find Buenos Aires, Montevideo, Rio de Janeiro, and São Paulo. Each of these cities is the trade center for a large area. Their manufactures may be described by saying that they have the butcher, the baker, the candlestick maker, and the repair shop. Such industries make things for the local market only. At the same time manufactures are the chief imports, coming mainly from northwestern Europe and eastern United States.

Brazil—a partial exception. The only important manufacturing industry of the Southern Hemisphere great enough to supply almost wholly the home market with an important trade commodity is the textile industry of Brazil. This is centered chiefly in São Paulo, a city on the plateau. A hydroelectric plant situated at the falls of the Tieté, a tributary of the Paraná, supplies the city with electricity.

Buenos Aires. The lights, trolley cars, factory wheels, and locomotives that move the trade of the country all depend upon coal from the Northern Hemisphere. The flat plain that surrounds this metropolis is without water power for hundreds of miles. There are many manufacturing plants in this city, the largest city south of New

York, but can they compete with Italy, Germany, the United Kingdom, or the United States? What are the products, and where are the markets in which Buenos Aires might try to compete? Do you see why her exports are so exclusively meat, wool, hides, grain, butter, and quebracho?

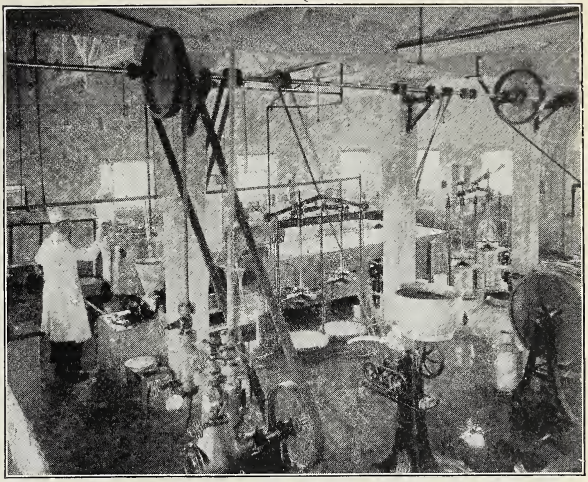


Fig. A. A laboratory in Argentina for testing the quality and the purity of milk.

THINGS TO DO AND QUESTIONS TO ANSWER

Unit review. 1. Answer the question that opens this unit.

2. Name some cities in the Northern Hemisphere whose industries resemble those of the Southern Hemisphere. Explain.

3. Compare home market and foreign market in the Southern Hemisphere and in Europe.

CHAPTER SUMMARY

Map work. 1. Make a list of the cities and countries mentioned in this chapter.

2. Locate them on your map.

New words. Use each in a sentence: Stimulating, invented, trunk line, abundant, transmitted, carving, balanced, prominent, tariff, skilful.

Weighing the advantages. 1. Read the list of needs for manufacturing (page 207) and show how each of several pairs of regions differ in some respects.

2. Every manufacturing region has a *local* market. Are all these local markets of equal value (Figs. 20-A and 286-A)?

3. What manufacturing countries are well supplied with home-grown breadstuffs (page 356), potatoes (page 356), meat (page 365)?

4. Explain all the ways you can in which climate affects manufacturing.

For review and thought. 1. What reasons can you give for France not developing her manufactures as some other countries have done? Why did England drop her agriculture (page 292) while Belgium, the Netherlands, and Germany have kept theirs?

2. What are the advantages of having factories in a country?

Debate the following topic: "As the United States develops, the New England section will become a section in which less manufacturing is done than at present."

Topics for special report. 1. Toy making in Germany.

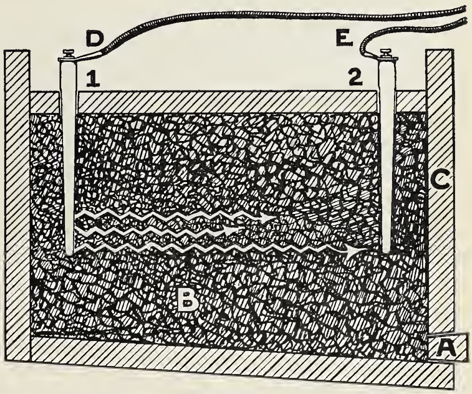


Fig. B. An electric furnace. "B" are the materials to be smelted in the furnace; "C" are heat-resisting walls, electricity from wire "D" passes, as electric sparks, from lower point of "1" to the lower point of "2." In so doing, it passes through "B," raises the temperature of the materials to 2400° F. or more, melts them, and they flow out at "A." Explain how this furnace might cause an industry to shift from one country to another.

2. The rise of industry in New England.

3. The proposed St. Lawrence waterway.

4. Why the South is developing new industries.

5. Great little Switzerland.

6. The wood resources of the Baltic countries.

7. Some industries that Palestine is likely to develop now that she has a great water-power plant. Explain your answer by telling about some other country.

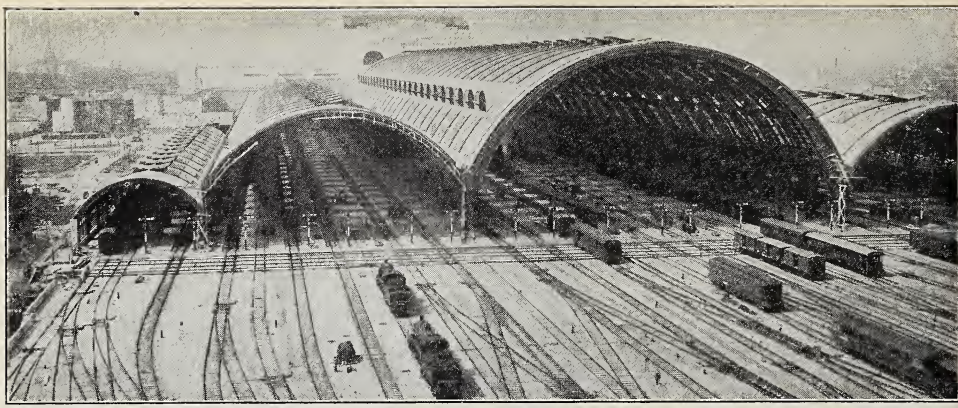


Fig. A. This grand station at Milano, in the plain of Lombardy, is part of a railroad system owned by the Italian Government. The express trains from Paris to Rome and from Paris to Istanbul pass through this station.

CHAPTER XXXV

THE FUTURE OF MANUFACTURING

UNIT 1—OUR NEW DEPENDENCE ON POWER AND POWER RESOURCES

> NATIONAL PLANNING. Some national planning boards are considering changes in industry that should be encouraged for the permanent welfare of their countries. What are some of the things such a board might decide concerning power resources in Canada, Japan, Switzerland, United Kingdom, United States, Denmark, or other countries that you may select?

The old ways. For most of its life upon the earth, the human race has used its own muscle for power—lifting and carrying; digging with stick, wooden hoe, stone hoe, shell hoe; hunting with club, spear, bow and arrow. Finally, metal was discovered, which made much better tools and weapons than man had ever had.

The new way and the prospect. Science and machinery gave man new powers which have enabled him to make many new things. The parents of many of you remember when there were few or no automobiles, probably no airplanes, no radio, perhaps no phonographs. Within a very short period of time new inventions have led to new manufacturing industries, and millions of people have been given work. New inventions have caused cities to grow in some places and cities to decline in other places.

What is the prospect for the future? Are the manufacturing regions that we have studied finished? If so, will they keep on as they are or will some decline? Or will this great burst of manufacturing continue to increase? If so, where will it increase? Will it increase in some places and decline in others? Where are the places of probable increase? Where are the places of probable decline? To answer these questions, let us examine some of the things on which manufacturing depends.

Sources of power. Modern manufacturing depends upon mechanical power. The man who stands at his machine may have under the control of his fingers a power equal to that of 100 men, 500 men, 1000 men! Some machines have the power of many thousand men; nevertheless the labor of hands still has some part in every industry.

At the present time most of the mechanical power is derived from coal. Wood is a good fuel, but it has less heat a pound than coal. Wood is used for steamboats and locomotives in forested frontier places. It is the domestic fuel in millions of homes. But it is rarely used as fuel for the factory engine.

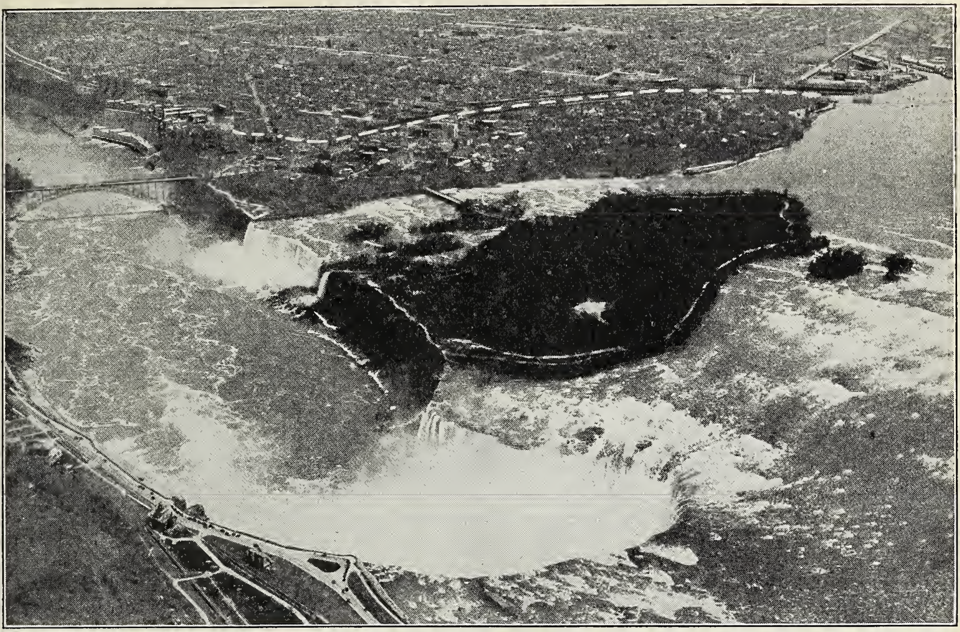


Fig. A. The waterfall at Niagara, and the town of Niagara Falls, New York, one of the towns the falls have made. ¶ This is the finest natural water-power site in all the world. The water, which by treaty with Canada we use on the American side, is divided into two parts. One falls through a power plant which can be seen at extreme upper right. The water then runs by a tunnel to the river below the bridge. The other half of the water goes by canal (- - - -) to a power plant, which we see below the bridge. Can you see the used water rushing back into the river?

If coal were evenly distributed over the earth, many countries would be very different from what they now are. Look at page 360. Consider the future of coal in the United States, Canada, United Kingdom, Japan, and Argentina.

No one would use coal if there were plenty of petroleum. It is much simpler to touch a button and let a stream of oil spray into your furnace than it is to feed the fire with coal. Petroleum is entirely burned away and goes up the smokestack as gas. Coal, on the other hand, leaves clinkers and ashes. It is also much easier to transport the oil in pipes than to transport coal in cars and trucks. But what does your study of petroleum tell you about the prospects of a city that depends only upon its near-by oil field?

There are large reserves of oil shale, but oil from that source will be more costly than the present oil which so kindly runs out of the ground for us.

No one would use petroleum if there were plenty of natural gas. Can you explain (page 230)? What are the prospects for the city that depends upon natural gas (page 230)?

Factors in water power. How long will a waterfall last? Which is better to use, water power or coal? The answer to the second question depends upon many things. Fifty years ago water power was not very important except for little country mills (Fig. 302-B). The dams of stone or wood were low and could be used only on small streams. Too, they were soon washed away. With the arrival of concrete, man was able to make a dam on almost any river. Improved water wheels were invented that caught the power from water in great quantity (Fig. 318-A). Dynamos

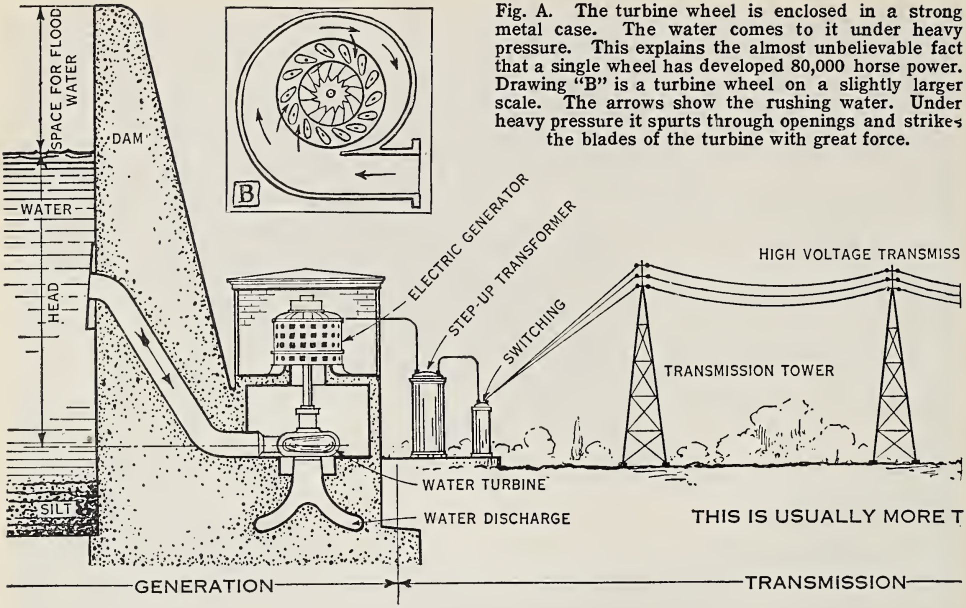


Fig. A. The turbine wheel is enclosed in a strong metal case. The water comes to it under heavy pressure. This explains the almost unbelievable fact that a single wheel has developed 80,000 horse power. Drawing "B" is a turbine wheel on a slightly larger scale. The arrows show the rushing water. Under heavy pressure it spurts through openings and strikes the blades of the turbine with great force.

were invented and enabled us to turn the power of the great water wheel into electricity. We then learned how to carry electricity by wire to distant places. For a time it seemed that water power would be much cheaper than steam, but engineers made improvements in the steam engine whereby more power was derived from the same amount of coal. The advantages of water power and steam are nearly equal. But great dams have recently been built to feed hydroelectric power plants in Pennsylvania, our greatest coal-mining state. Unfortunately, there is not enough water power in the United States to supply our present power needs.

Head. A stream must have a fall in it before we can get water power. The total distance of fall that we can get as the water goes through the wheel is called the *head.* Modern water wheels can use heads of several hundred feet. Compare this with the old country mill (Fig. 302-B).

Steady flow. If a stream runs only six months, the water-power plant can serve only for six months at best. How do the rainy seasons of some of the regions (Figs. 2-A and 28-B) fit into the idea of water power?

Snow and glaciers on mountains are at present very important in those parts of the world where water power is most used. They melt in summer. This makes the streams flow at a season when in some climates they are at their lowest. But compare the service of a glacier and mountain snowfields in the Mediterranean climate with that in the Indian monsoon climate. If a stream drains forest-covered land, its flow is more regular, because the decaying leaves on the ground hold back the water and give it time to soak into the earth. Water thus saved comes out as springs. If the forest is cut off, floods increase and so do periods of very low water.

Lakes. For hundreds of years men have built small dams in streams to hold the water for an hour or two, so that it might collect and run water wheels. A lake is a natural reservoir of great aid in making a stream flow evenly. For example, consider the Potomac River, which has no natural

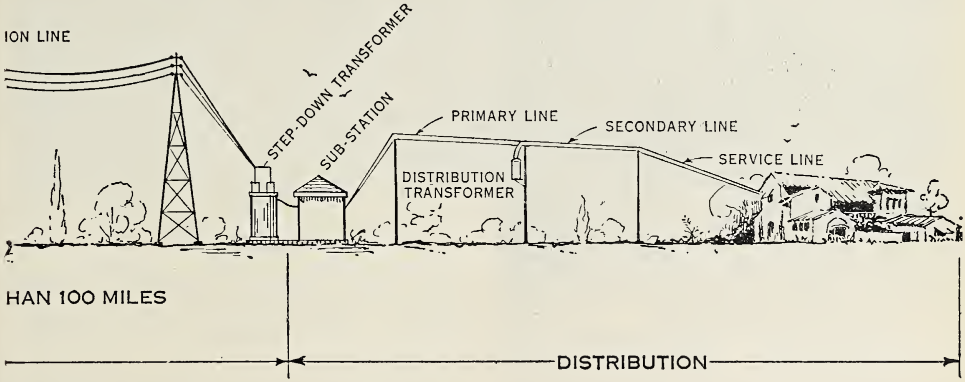
lakes. It sometimes carries 500 times as much water as it does at other times. The Niagara River flow varies only about 50 per cent. Look at the map (Plate IV) and tell the reason.

Glaciated regions. You doubtless remember what the continental glaciers did to the surface of the country over which they passed, and how glaciers helped to create water power. It was the glaciers that made the Niagara of today. It was the glaciers that gave us the great power of the St. Lawrence, which the United States and Canada now plan to use.

New England and eastern Canada may thank the glaciers for most of their splendid water power. The great power plant at Keokuk, Iowa, on the Mississippi, turns out much more power in the summer season because of the thousands of small glacial lakes in the glaciated woodlands around the source of the great river.

Switzerland, Scandinavia, the Puget Sound region, and Alaska possess every water-power advantage. They have, or are near, mountains that have been glaciated and now have glaciers and snow fields.

The great water power of the Colorado River, which the United States Government will sell at Boulder Dam for one and sixty-three hundredths mills ($0.00163) a kilowatt hour, depends in part upon melting snow. Unfortunately, however, the snows of the mountains at the source of this stream are gone by the end of summer. What would be the effect on Boulder Dam power if two or three high, rugged mountains were near its source with a hundred square miles of perpetual snow and ice upon their tops?



Power from wind. For a long time the Dutch, Germans, and Danes on their level lands have used windmills to grind grain. The Dutch use windmills to pump water out of the meadows they have reclaimed from the sea. Recently the Dutch have been winning more meadows from the sea. For this they use British and German coal to drive centrifugal pumps.

Thousands of American farms have windmills for pumping water. The wind may again be used as a source of power even for factories. This might happen even before coal and oil become scarce if better windmills are invented. If this comes to pass, a windy spot may become as useful as a coal mine or a waterfall. Fortunately, England has several such spots—many British hills, called *moors*, where the wind blows so hard trees do not grow. I have walked on the moors of Wales on a bright, sunny, summer day, and the wind roared in my ears so loudly that I could scarcely hear a man speak. I had to hold my hat to keep it from being blown away. And that was in good weather!

In the Southern Hemisphere in the Falk-

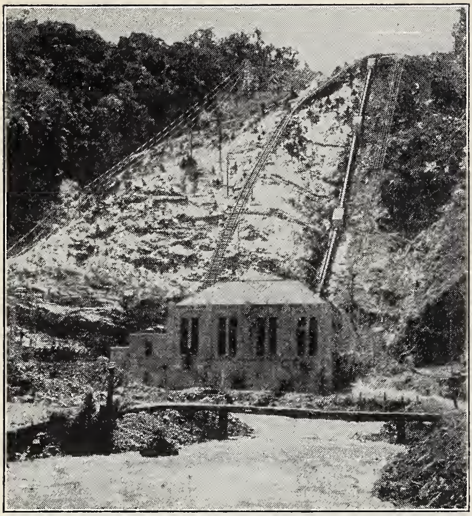


Fig. A. A company with headquarters in New York City owns this Brazilian plant. The penstock (pipe) carries water to make 8000 kilowatts, more than 10,000 horse power. Find the transmission line.

land Islands it is so windy that no trees can grow, and in southern Patagonia the wind is almost as bad—or as good, according to the way you look at it.

Perhaps some day men may be taking shiploads of food and raw materials to feed the power-using cities that may be built in the sheltered nooks of these lands. People there will then support themselves by working in factories where the motors are driven by electricity from the windmills on some exposed hill not far distant. The food and raw materials needed for supporting industry will have to be brought in ships from other parts of the world.

The American Great Plains, the tops of the White Mountains, and many other mountain locations may become important sources of power if windmills replace coal mines as a source of power.

Power from sun heat. It is a well-known fact that the sun's rays in such deserts as those of California, Arizona, and other hot places, have enough energy to supply all the needs of man many times over. The question is, can inventors find a way to use this power?

Power from the earth's interior heat. There is enough heat in the interior of the earth to run all our machines for ages, but there is little hope that it can be an important source of power except near volcanic regions. A few engines are being run by such heat in Italy and California.

Power from tides. A great amount of energy is spent upon the earth every day by the rising of the tides. In a few places this can be caught back of dams in narrow bays and used for power, but men cannot catch enough energy to meet the needs of any country.

THINGS TO DO AND QUESTIONS TO ANSWER

Make lists and maps. Using the six sources of power as headings, make lists under each one of places in the world from which such power can be derived. Make a map and show their location.

Do you know? 1. Why is oil a more desirable fuel than coal?

2. What are the advantages and handicaps of water power? of coal? of wind?

3. What are the advantages of gasoline? of electric transmission? What changes have they helped to produce?

4. Make a map of United States and show in some way the states that have the most unused water power; the most used power (page 374).

5. Do the same for foreign countries (page 364).

Pretend. 1. Pretend that you are living five hundred years from now. Write a paper telling how and where the world is securing its chief sources of power. Justify your statements. Tell how coal and water power have competed.

2. Make an imaginary map, placing cities where you think they are most likely to develop.

A new source of power. 1. The Belgian Congo has great possibilities as a producer of electrical power. Can you tell why? To get the answers look at Plate XVII and Figures 22-A and 23-A.

2. Why has it not been more fully utilized? Compare this source with that of Victoria Falls as to possibilities regarding regularity of power and location for utilization. See Figures 22-A and 23-A and note carefully the times of rain on Congo and Zambezi.

Extra credit. Find from the Federal Power Commission, Washington, D. C., the plans for power at Boulder Dam; the St. Lawrence waterway.

Fig. A. This scene on the banks of the Nile has changed little, if any, in the last 5000 years—mud village, oxen plowing with crooked stick, and camels coming in from the Desert to tarry a little while in the fertile lands by the Nile. These camels are carrying *mud* from the Nile to fertilize the field.

UNIT 2—FOOD SUPPLY AND FACTORY RAW MATERIALS FROM PLANTS

> Land Utilization. What might a planning board say about the use of land to serve the future needs of the manufacturing industries?

Food. We may say that food is the primary raw material. Man depends upon food for strength and energy. When you cut down a tree, dig iron and coal, plant a crop or run a race, you are using strength and energy that you have derived from your food. Man gets together many raw materials for the factory, but we can in a sense say that all comes from man's *work,* and that work (energy) comes from *food.*

Many other factors enter into man's work, however. He must have a climate suitable for plant growth and one reasonably comfortable for himself. Above all, soil and soil fertility must be present to nourish the plants.

Soil resources. The worker in the manufacturing city must have food. Therefore maintaining the food supply is as important as maintaining supplies of fuel or raw material.

Keeping a permanent food supply is something that man has not succeeded in doing very well in most places. The Nile Valley has a permanent food supply because the river in annual flood brings fresh fertility to the soil. For this reason the valley has had a dense population for several thousand years. Most of the upland areas where the population is dense have not kept a permanent food supply or a dense population over a very long period.

China and parts of Japan have had many people to the square mile for many centuries, but those countries have a permanent agricultural system on some of their land. Much of their cultivated land is in rice paddies, or on other level plains that cannot erode. Such lands do not waste soil fertility. The Chinese or Japanese farmers grow a crop which they themselves eat, or they feed some to the few work animals they possess. The manure of both man and animals is saved and carried back to fertilize the fields. The nearest approach to this system is that of Europe and America. There the farmer keeps meat animals or milk animals. Their manure is usually saved and returned to the fields. Thus most of the crop is fed to the animals and a large part of the fertility returns to the land. This, in combination with what the plants can get from the air and the

Fig. A. At one time this land was forested; then it was cultivated; then it was allowed to lie fallow. See the gully which the rain has dug. How might this destruction of fertile surface soil have been prevented?

small amount that is released each year by the breaking up of earth material, maintains permanent fertility in most soils—*if* the land is not allowed to wash away.

Our commercial agriculture. The age of machinery has completely changed the source of city food and thus it has changed the distribution of men on the land. In our own country the first census, in 1790, showed 3.3 per cent of the American people living in places having above 8000 inhabitants. In 1840, the percentage was 8.5; in 1890, 29; in 1930, 49.1. Some of the countries of West Europe show an even greater percentage of people living in the cities.

To feed these city populations we take plant food from the wheat fields of Dakota or Australia or Argentina, and use it in Chicago, New York, London, or any other city. After this the fertility enters city sewers and never gets back to the fields. The result of this system is a rapid increase in the use of commercial fertilizers. The most vital of these is phosphorus, an irreplaceable mineral resource. The supply of phosphorus is limited. The length of time that it will last is short compared with the time man has already been on the earth.

Soil erosion. The loss of phosphorus, through crops, is, however, a small loss in comparison to that by soil erosion (page 200). Our country is so huge and we have had so much land that people have had the idea that no harm is done if they destroy the soil covering of a piece of land. We have recently begun to study carefully this matter of erosion. Mr. H. H. Bennett, of the Department of Agriculture at Washington, a great authority on this subject, says that 350,000,000 acres are in crops and that we have ruined or badly injured 260,000,000. He also says that they are the best acres we have, and that in the very short time we have been in this country we have destroyed or greatly injured good land as follows:

1. Approximately 35,000,000 acres of formerly cultivated land abandoned and too badly eroded for practical reclamation for the average farmer;
2. Approximately 125,000,000 acres which have lost all or the greater part of the humus-charged topsoil (this now in cultivation or in temporary pasture or in temporarily idle farm land);
3. Approximately 100,000,000 acres headed in the direction of the land under Item 2.

It is plain that if manufacturing cities are to be fed, grow, and be supplied with plenty of raw materials, we need to reform agriculture quickly in this country.

THINGS TO DO AND QUESTIONS TO ANSWER

Do you know? 1. Why a permanent food supply must be maintained?

2. Why commercial fertilizers must be used to keep up the food supply?

3. What might be considered the primary raw materials?

4. Why the Chinese are able to maintain the fertility of their land?

Some problems for thought. 1. How has the presence of great natural resources in the United States led to carelessness in their use?

2. If we are to continue a high standard of living, what are some things that national planning must attend to?

3. Compare the percentage of people living in cities in western Europe with the figures given in this book for the United States. How does Europe feed these people?

UNIT 3—GOOD GOVERNMENT AND MANUFACTURING

> A POLICY FOR CHINA. Tell what the government of China should do to help China become a manufacturing nation.

Fig. A. These Japanese women are having their pictures taken because of their interest and improvement in the care of the babies. The Japanese Government runs good schools of many kinds and does many things to encourage good health as well as industry and trade. Notice the two kinds of shoes, one made without leather, using straw or wood and fabric instead.

Civil wars. For some years past China has had civil wars. Two generals—sometimes three, four, or even five—each with an army, have tried to capture the country. It takes money to support an army. To get this a Chinese general will enter a town, go to the various merchants, and say: "You must pay so much money or I will take everything you have, or hold you as a hostage, or cut off your head." A few years ago one of the generals forced the greatest Chinese actor to contribute $200,000 to the general's war chest.

Under such conditions it is almost impossible for people to acquire wealth. Even if they had the necessary money they would scarcely dare build a factory. A factory would advertise the fact that the owners had money, and that would be a great temptation to the generals.

The new need for security. In spite of the plague of civil wars which exists in China, the farmers working under the domestic system can usually manage to keep going. Some starve, however.

In Persia, where the government is almost as bad as that in China, the villager often buries his wheat in a secret place to keep it away from the taxgatherer, who is almost as bad for business as is a Chinese general.

Men will build a factory only where they can be reasonably certain of being safe from marauders. The factory, with its expensive machinery, must have protection. Look at the electric-power line that runs from Baltimore to the Hudson Valley and there connects with Niagara Falls and Rutland in central Vermont (Fig. 296-A). There are other lines of equal length that spread across the United States, Canada, and Europe. The lines extend over hill, valley, mountain, forest, and stream. This line must be in a place where property is reasonably safe or no one will be willing to build it.

Consider an irrigation canal. It is many miles in length. It is almost like a power-transmission line in the continuous protection and care that it must have. In periods of good government canals have been built across the plains of Mesopotamia; farms have spread across the land that had been desert, and millions of people and large cities have been supported. Then perhaps some general with his army rode in, or some corrupt taxgatherer came, like the Turks of the nineteenth century, and took possession. The canals filled with mud; the farmers vanished; the cities became only ruins.

Scientific investigation. Modern manufacturing requires scientific research. This means laboratories, expensive materials, costly machines, and investigators who have spent years in study and have the aid of skilled assistants. It is true that in America and Europe much research is done by private corporations, but they have grown rich and great only in periods of peace such as China does not have. There is much research that is of great value to

the nation and the race, but of so little value to one person or even to one corporation that only governments can afford the expense.

Education. The age of science and machinery has come with education—education for everybody. The United States, Canada, Japan, every country of West Europe, has free schools supported by the government. The purpose of some of the schools is to educate the people to run the industries.

Justice. An industry cannot thrive if the police arrest people whenever they want to, for anything they please. Industry cannot thrive when the judge in the courts gives decisions in favor of those who give him money rather than because of the justice of the case; or where racketeers prey upon industry.

Great resources IF—. Our survey of the industries that make the crops, the raw materials, and manufactured goods shows that for the present we have great resources. We have resources for a great increase of industry, increase in wages, increase in comfort. This increase will come if man can control himself by means of good government, education, and a system of industry that permits everyone to work who wishes to do so.

Putting the puzzle together. We have now become acquainted with all the pieces of a puzzle. Let us put the puzzle together. Let us examine the regions one by one, or examine the countries one by one, or, let us do both.

(*a*) Make a list of the necessities that will be needed by a large works producing ————, and by the factory town that a thousand factory workers would require. In the blank space we will put, in turn, the words: cotton cloth, woolen cloth, shoes, canned and frozen meat, lumber, paper, iron and steel, textile machinery, automobiles, farming machinery, watches, ships, chemicals, glass, cement, musical instruments.

(*b*) Now think of placing this factory in any one of many regions or many countries or many states. Give it an exact location. Make a list of the things the factory will need that are near-by. Make another list of the things that can be had only by transport and trading with another part of the same country or with a foreign country.

(*c*) What other regions or countries will help with this necessary trade?

(*d*) When you have finished this study, answer some of these questions:

1. Will what may be called *raw-material regions* and *manufacturing regions* continue to exist?
2. Does your answer to question 1 mean that you expect an increase or a decrease in international trade?
3. Make a series of sketch maps of the world. On each draw regions which you think will have similar exports. Write these exports in the order of their importance. Make as many *export-regions maps* as you can.
4. Do the same for *import regions*. Can a region import without exporting?
5. Examine the population-density map (page 20) and explain the reason for the density of population in all large areas having it.
6. What are some of the changes that may result from the use of air-conditioning apparatus that may let us build, in any hot country, factories, houses, hotels, apartments, schools, stores, and other buildings in which the temperature and humidity would be like those of the best climate in the world?
7. Make a sketch map or sketch maps showing regions which you think might easily hold more people in comfort than now live there. Explain why this may be the case.

   Give some idea of how many people each region or area might support on a square mile of land.
8. Pick out areas that cannot support much increase in population.
9. Pick out areas that are likely to decline in population (Figs. 53-B, 221-A, and 322-A).

CHAPTER SUMMARY

Can you answer these? 1. Is good government becoming more necessary or less necessary to manufacturing?

2. How do justice and education help industry?

Prove these statements. 1. Men will invest their money only where they think it is secure.

2. Modern manufacturing requires scientific research; exports and imports.

3. We should build more reservoirs in the United States like that in Figure 302-A.

New words. Use correctly: Head, spigot, hydroelectric, glaciated, centrifugal, and moors.

Pictures. Make a list of the things that you learn from examining the pictures in this chapter.

Watch your newspapers. Watch for clippings pertaining to future developments in production.

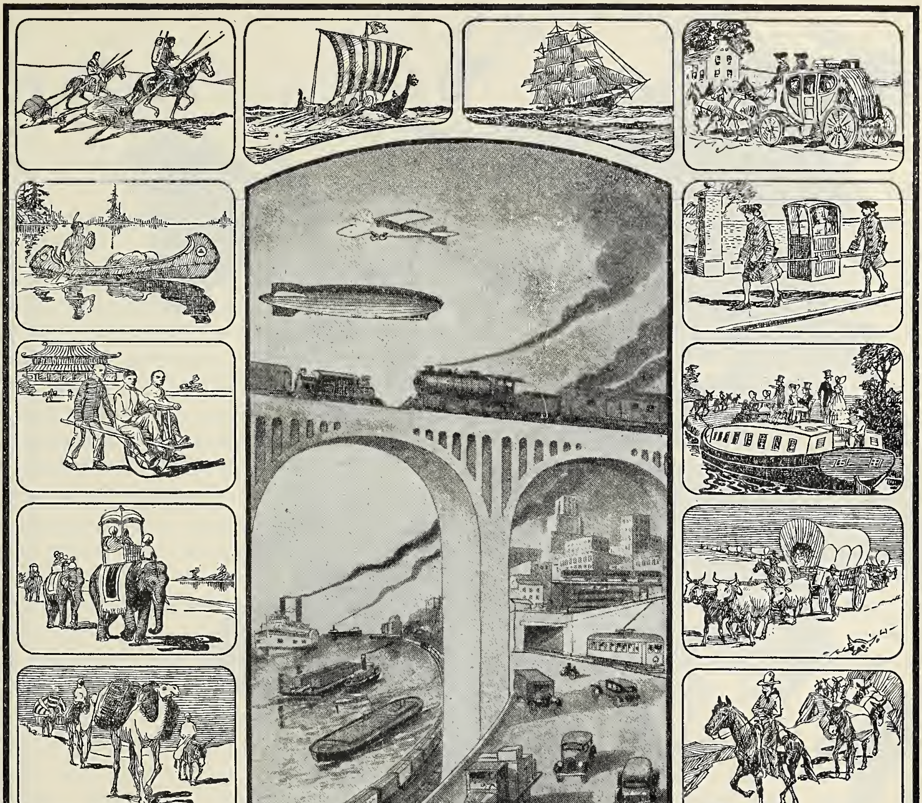


Fig. A. Tell something about each of the kinds of transportation which you see in these pictures.

Fig. A. On this map of the continents the railroads are shown by means of white lines fifteen miles wide. In some localities the railroads are so close together that the area is white. (These maps are used by courtesy of Mark Jefferson and are copyrighted by him.) Study them carefully.

CHAPTER XXXVI

TRANSPORTATION, COMMUNICATION, AND TRADE

UNIT 1—TRANSPORT BY LAND

> Sustenance Space and Invention. Can you point out some things about the size of a man's sustenance space (page 5) and the things mentioned in this unit?

Steps in advance. There have been many stages in the development of transportation since man carried his own produce in his hands or on his back or on his head. Pick them out in Figure 325-A.

The most important of the forward steps in transportation were: (1) taming animals which are stronger than we are; (2) the invention of wheels; (3) the invention of the steam engine; (4) the invention of the gas engine, which runs the automobile, the truck, and the airplane.

The only newspaper in Tibet published an article in 1933 which said that the unemployment troubles of the white man's world had come from the invention of wheels. Said the Tibetan editor, "With wheels two men can do the work of a thousand. The thing to do is to quit using wheels, and all men will have jobs again."

Transport by human muscle. Man is still his own burden bearer in several parts of the world. In the Equatorial forests of Africa and South America insects, wild animals, and diseases kill many domestic animals. Man is the burden carrier.

You know (page 18) why China, Japan, and India have so few animals and you know that man in those countries does an important part of the transport work by carrying freight on his back, head, or carrying pole (Fig. 325-A), or by pushing wheelbarrows and pulling carts. The same is true in some parts of Mexico, Peru, and other Andean countries, and in some of the West Indian islands, Madeira, and other densely peopled areas.

Transport by means of animals. Animals furnish the power on more than half of the farms of the United States and the Southern Hemisphere, most of those of Europe, and the larger farms of Asia. Only a small proportion of the farms in America and Europe are fully motorized. Even in the United States the horse still competes with the truck in carrying produce from the farm to the railroad station. The animal caravans of Asia and Africa still make long journeys over the roadless, sparsely peopled, arid, or mountainous lands. In the Andes, the Rockies, the Himalayas, and nearly all other inhabited mountain regions, trains of pack mules or horses or donkeys or oxen or llamas or yaks or goats still do service.

The railroad. A *ton-mile* means a ton of freight carried one mile. Find the cost of a ton-mile, in hours of man labor, for the African carrier who carries 100 pounds on his head 20 miles in one day. Find the cost for the farm wagon, with a man and two horses, carrying 3000 pounds 20 miles in a day; for the truck with which one man carries five tons 150 miles in a day; for the coal train of 50 cars, carrying 100,000 pounds each, and a crew of five men, going 100 miles in a day.

You can see that the railroad still has the advantage for carrying large quantities of freight over long distances, but the quick-moving truck, automobile, and bus have taken much short-distance freight and passenger traffic away from the railroads and street-car lines.

With the aid of machinery, cement, and dynamite a railroad can now be built almost anywhere on the surface of the earth. The really important question is, Will it pay? Are there enough people, resources, indus-

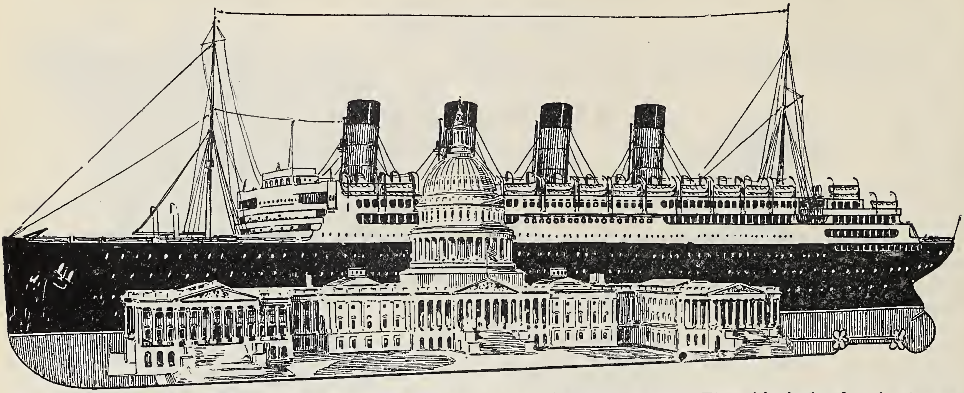


Fig. A. An ocean steamer and the Capitol at Washington, drawn to scale. The ship is by far the largest moving thing that man has created. It has been called a floating hotel. It is almost a floating city.

tries, freight, passenger traffic to let the railroad earn a fair return on the cost? No one wants to build a railroad in a desert, unless it is to be connected with rich lands beyond, or to bring out minerals, as is the case in the deserts of Chile, Nevada, and Australia.

The cost of a railroad depends much upon the character of the country. If it is hilly it may be necessary to make many cuts and fills so that there will not be too many steep grades. If there are mountains, tunnels and high bridges must be built.

Find the mountain areas on Figure 326-A; then find them on the physical maps (Plates III, XI, XVII, XIX, XX).

After a railroad is built, it must be maintained, for it rusts and wears out.

The electric locomotive makes no smoke or cinders; it stops and starts more quickly than the steam locomotive. It takes less coal to make the power in a good power plant than it does in the wasteful locomotive. But the cost of building a road for the electric train is so great that only a small part of the world's railway mileage uses electricity.

THINGS TO DO AND THINK ABOUT

A map. Find maps of present airplane service. (See your post office.)

Terms. Use these terms in sentences: ton-mile, earn, Tibet, China, Africa, pack animal, new development, new railroad, caravan, dynamite, mountains.

UNIT 2—TRANSPORT BY WATER

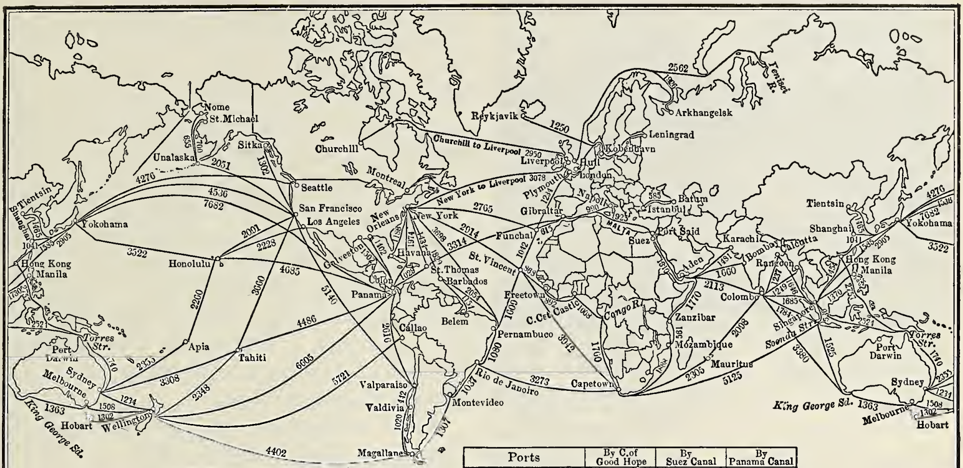
SIGNIFICANCE. A hundred years ago people took a sea journey with fear. Compare that with the present attitude of people about to cross the ocean. If there is a change, what does it signify and what are the causes for it?

Many steps of progress. In water transport, also, man has advanced his powers by many stages. Probably he first rode a floating log; then he tied two logs together with a vine, thus making a raft. Then he advanced to the paddle or oar, the sail, the horse to draw a canal boat, and finally to the engine burning wood, coal, oil, or gasoline.

The sail, which carried man across the sea for many centuries, has almost disappeared because of the competition of the engine. In small boats the engine is driven by gasoline. In large boats it is driven by coal, by oil under the boiler, or by the Diesel engine, which is much like a big automobile engine that uses crude oil instead of gasoline.

Wood, which was used on the first steamship that crossed the Atlantic Ocean, in 1819, is now used only a little on river steamers here and there in forested frontier countries.

Tramp or charter traffic. If you have enough freight to fill a ship, you can hire (charter) a ship to take your freight across



Ports	
Montreal to Liverpool	2785
London to Kobenhavn	704
London to Leningrad	1519
London to Plymouth	321
Gibraltar to Malta	990
Malta to Istanbul	859
Soenda Str. to Singapore	530

Ports	By Magellan Str.	By Panama Canal
Valparaiso to New York	8380	4633
San Fran. to New York	13135	5262
Seattle to New York	13910	6039
Honolulu to New York	13312	6702
New York to Valparaiso	8380	4633
New York to San Fran.	13135	5262
New York to Seattle	13910	6039
New York to Honolulu	13312	6702

Ports	By C. of Good Hope	By Suez Canal	By Panama Canal
New York to Bombay	11395	8174	14982
New York to Colombo	11133	8607	14112
New York to Calcutta	12254	9816	14165
New York to Singapore	12409	10154	12522
New York to Hong Kong	13687	11605	11212
New York to Shanghai	14427	12361	10667
New York to Yokohama	15099	13056	9699
New York to Melbourne	12838	12975	9945
New York to Sydney	13306	13437	9691
New York to Wellington	14034	14356	8522

Fig. A. This map shows the steamship routes and distances between certain of the large ports of the world.

the sea, just as on land a shipper can ship a carload of goods by railway, or by truckload on a highway. Since these ships go anywhere, they are often called *tramps*. Let us follow such a ship.

She is built at Newcastle, England. Her first cargo is coal to Buenos Aires; then wheat to Liverpool; then steel rails and locomotives to Rio de Janeiro; coffee to New Orleans; cotton to Kobe; coal to Manila; sugar to Seattle; lumber to Soerabaja, Java; sugar to Bombay; wheat to Anvers; then back to her home port in ballast. Ballast is some worthless weight put into a ship to hold her down so that she will ride safely.

There are many hundreds of such tramp ships working their ways around the world. There are many hundreds of shipping agents in several hundred ports whose business it is to help these vessels find cargo and to look after them when the ships are in port. Tramp steamers nearly always haul raw materials: grain, coal, lumber, pulp wood, wood pulp, cotton, jute, ore, phosphate rock, nitrate, potash, salt, building stone. Some countries pay for their imports by the earnings of shipping. Norway has 1.44 tons of shipping for each person; United Kingdom 0.44 tons; the Netherlands 0.39 tons. The United States has but 0.11 tons.

Ocean-line traffic. The single shipper of typewriters, books, drugs, automobiles, machine tools, and a thousand other manufactures, cannot hope to load a ship. Such traffic goes by *line steamers*. Many companies advertise that their line ships will sail on given dates from certain ports to certain other ports and that the liners will carry all suitable freight for all shippers. Find the advertisements in newspapers of any large seaport city.

The greatest line traffic is that between northeastern United States and northwestern Europe. There are dozens of lines from New York, Boston, Montreal, Halifax, New Orleans, and there are also dozens of lines reaching Liverpool, London, Anvers, Hamburg, Havre, Marseille, Genova, with smaller numbers to Köbenhavn, Newcastle, Bergen, Stockholm, Bordeaux, Peiraievs,

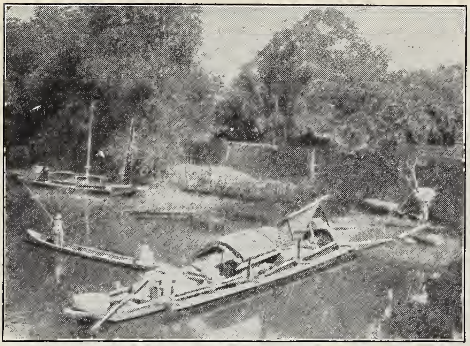


Fig. A. Flour from the United States going ashore at a Philippine village. The boat came from steamer side in the harbor at Manila. Thousands of such native boats pick their way along hundreds of rivers in southeastern Asia and the East Indian islands.

Alexandria, Istanbul. The city of Anvers alone has 110 lines of steamers, of which nine go to the United States.

It is usual for companies having lines of large steamers at the great ports to have lines of smaller vessels to collect and deliver freight for them. The smaller boats serve ports and rivers with shallow draft. Thus small boats give cheap water transport to the farthest places boats can go.

There are lines from New York, London, Anvers, and Hamburg to every continent. Los Angeles, San Francisco, Seattle have lines to the Atlantic and across the Pacific, and they help to make Tokyo and Shanghai great ports. East Asia is visited by lines that go out from New York and western Europe and pick up the freight that has been collected by smaller lines at Bombay, Calcutta, Colombo, Singapore, Manila, Hong Kong. There are also lines which regularly sail around the world.

River boats. Boats on rivers have played an important part in developing settlement and trade in our own country and in other countries. River boats have been greatly changed by many inventions.

The flatboat. The early American farmer hauled grain in his farm wagon a few miles to the port or to a river bank. Here he put it in a sailboat or on a flatboat. A flatboat was very wide and shallow and could float down swift streams in water only a foot or eighteen inches in depth. Sometimes the boats were brought back by great labor with poles; sometimes they never came back because the waters were too swift. In the days before railroads these boats were taken down streams where boats no longer go—the Connecticut River, the Mohawk, the Susquehanna, the Potomac and many of its branches. This traffic on swift streams has almost disappeared from the United States, but there is still much of it in China, where there are few railroads. Sometimes the Chinese boats are taken back upstream by the labor of men tugging at ropes.

River steamers. In 1807 a steamboat went from New York to Albany. In 1815 the first boat from New Orleans reached Louisville, Kentucky. By 1820 river steamers, whose flat bottoms allowed the boats to go over shallow places, were common in Europe and the United States. From 1820 to 1860 the period of river-steamer traffic was most important. Boats went up the Mississippi from New Orleans to St. Paul, to Pittsburgh, up the Tennessee, the Cumberland, and other branches. Vicksburg, Memphis, St. Louis, and many other towns thrived because the river steamers made them important. Kansas City and other steamboat towns on the winding Missouri River became outfitting places for Rocky Mountain fur traders and for expeditions that went across the plains.

Railways and rivers compete. A river is often crooked and therefore a long route, and it is a tricky waterway. In cold climates it freezes in winter. In most climates the water gets low at some seasons of the year; the sandbars shift to new positions; falling trees make trouble for boats, and hidden rocks catch the boats at low water. Therefore the railroad has reduced river traffic on many a waterway where boats were once important, but freight boats still run on the Mississippi and the Ohio. In 1933 Chicago rejoiced over the opening of a canal to connect her lake harbor with the Mississippi (Fig. 297-A).

River transportation today. Figure 326-A will show you places where the railroad has not injured the importance of the river steamer to any great extent. The Amazon is the sole highway for two or three million square miles of inner South America. The boats on the Magdalena River are the only means by which freight reaches many parts of Colombia; several short railroads serve as trade branches to the river. For many years the Paraná River has been the one outlet to Paraguay and adjacent parts of interior Brazil, Bolivia, and Argentina. The Congo is the great freight route of central Africa; the Yangtze of central China; the Si of south China; the Nile of Egypt; the Ganges of India.

Look at Figure 2-A, Figure 63-A, Figure 87-A, and Figure 20-A and tell why the Volga, the Danube, and the Rhine are the three great river highways of Europe. The Weser and the Elbe give an outlet to the sea to important manufacturing regions, and the Scheldt and the Thames have great traffic for the short distances between Anvers and the sea, and between London and the sea.

Canals and canal boats. In the latter part of the eighteenth century Englishmen began to build canals, whose locks let boats go up and down from level to level. In the half century from 1790 to 1840, canal building boomed in Europe and eastern United States. The great success of the Erie Canal in 1825 spurred others on to work. We had quite a system of canals in the United States. They crossed New Jersey, Pennsylvania, Ohio, and Illinois, from river to river. Boats were so made as to separate in two pieces and go on wheels so that they could be carried on inclined planes over the mountains of Pennsylvania. The railroads killed most of these canals, although in some favorable places canals are still important, as in the Netherlands, Belgium, and parts of France and Germany. The engine has replaced the mule and horse as the source of power in many canal boats. China has more canals than all the rest of the world. They cross the eastern plain in all directions and still serve both as highway and railway to millions of people who push their own small boats.

Fig. A. The harbor and city of Rio de Janeiro, Brazil. Tell why this is said to be one of the world's best harbors.

Ship canals. In the present period of railroads the most important canals are those that allow ships to pass from one large body of water to another, such as the canal around the rapids at the end of Lake Superior, the Welland Canal between Lakes Erie and Ontario, the St. Lawrence Canals around the rapids of that river. We see another type of canal in Manchester, England, and Houston, Texas, where canals have made seaports of these two cities.

The greatest of all canals are at Panama and Suez, where the largest ships pass from one ocean to another. The traffic at Panama has become so great that people are talking about a new canal. Canals at Kiel in Germany, Korinthos (Corinth) in Greece, and the base of Cape Cod are of smaller importance. Examine the map and tell why this is true.

DID YOU GET IT ALL?

Terms to use in sentences: tramp, ballast, liner, sailing date, tons of shipping, Singapore, Los Angeles, flatboat, fur, ice, Chicago, Magdalena, Congo, our nearest port.

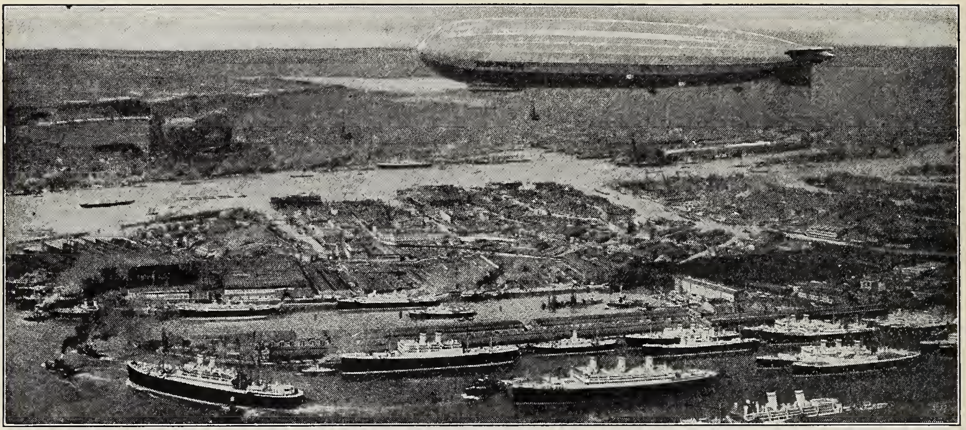


Fig. A. The harbor, Hamburg, Germany. Find the river; the old artificial harbor; the newer artificial harbor. What other things do you recognize? From what places may trade come on this river?

UNIT 3—PORTS

CHANGES. "BIGGER, BETTER, FEWER." How do these three words explain the history of ports during the last hundred years?

Ports. A ship is the greatest moving structure man has made, but waves bounce a ship as though it were a cork. The one thing that is most certain to ruin a ship is for its bottom to touch ground. Therefore it is very important to have harbors where ships can lie in quiet, deep water while they load and unload. It is better that a harbor should have a narrow entrance, because that keeps the waves out. It should be situated in a deep bay surrounded by hills. But many ports have nothing but a breakwater, which is stone wall built to extend a few feet above the surface of the water (Fig. 74-A). The wall stops the waves and thus protects the ship from being bounced by waves or thrown against the shore.

Many ports cannot afford a breakwater because their traffic is light or because the water is too deep to permit a stone breakwater. For these reasons ocean steamers anchor in some places a mile or two from shore. Little boats, that bob up and down on the waves beside the ocean steamers, load and unload most of the goods that go to and come from the west coast of Africa and the west coast of South America. In this way much property and sometimes even lives are lost. Such a city as Valparaiso is open to the west wind, and on windy days the waves rise and no freight is handled.

Depth of water. It is necessary that harbors be deep. New York harbor has a depth of forty feet. In most of the ports of the world dredges work constantly to keep harbors free of sand and mud and to make channels deeper. The *tide* is a great aid in making harbors. If the tide falls six or eight feet, the water as it rushes out deepens the channel (Fig. 291-A).

Space. In the best harbors ships can tie up to docks or wharves having freight sheds upon them. New York has one of the finest harbors in the world. The island form of the city and many miles of bay front give room for 770 miles of developed water front. No other harbor in the world is so favored by nature.

Rio de Janeiro is another harbor with a magnificent bay and plenty of room; so is Hampton Roads, at the mouth of the James River. London, Hamburg, Anvers, and Bremen are located on narrow rivers which long ago became choked with shipping. To make more harbor room, huge excavations were dug in the meadows and docks were built there (Figs. 291-A, 331-A, 332-A).

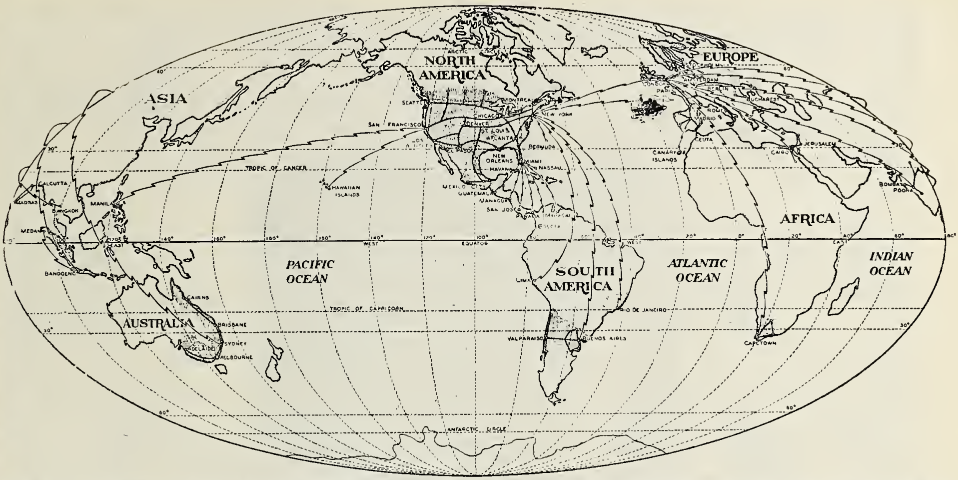


Fig. A. Overseas telephone connections. Name some far-away places which you might call from your telephone. In addition, telephone service has been established between land telephones and certain of the larger steamships.

Ice and fog. Harbors should be as free as possible from fog and clear of ice at all seasons. What can you tell about the harbors of Finland (page 51)? of Vladivostok? of Montreal?

Hinterland. A good harbor can become the site of a great city only if it is a natural shipping place for the trade of a rich and populous country. You know about the Erie Canal and New York City. The coasts of Maine and Norway, full of bays and sheltered by islands, have enough *harbors* for the ships of all the world.

The increase in the size of ships in the last hundred years and the coming of the railroads have done much to make a few ports grow great and have caused many small ports to dwindle. In the days of small sailing vessels the port of Salem, Massachusetts, had almost as much trade as the port of Boston, and there was a time when towns on small tidal creeks in southwestern New Jersey carried any ship that came to America. These towns were then as important as Philadelphia.

THE ESSENCE OF IT

Dividing it. See how many different topics or subjects for short talks you can make on *ports and harbors.*

UNIT 4—EXCHANGING IDEAS

CHARACTERS IN HISTORY. Let each of four members of the class say he is ——— (some historical character), then tell the class how he sent a hurry message 1000 miles, and how long it took to do it.

Many ways. Can you follow the steps of man's advance in sending an idea to another man (Fig. 334-A), by: messenger, signal fire, drumbeat, flaming arrow, sign language, smoke signal, town crier, rocket from a ship at sea, carrier pigeon, messenger on horseback, semaphore (used on railroads), wigwag, letter, telegram, telephone, radio, and television?

As with transportation, many of the changes in exchanging ideas have been made within a few decades.

Messengers and stagecoaches. Cheops (who built the Pyramids), Julius Caesar, and George Washington depended upon the man on horseback to carry messages in a hurry. Paul Revere was such a messenger.

The first daily newspaper in the United States was published in Philadelphia in 1774. The newspapers were carried by horseback and stagecoach, several days being required for news and letters to go from Boston to George Washington at

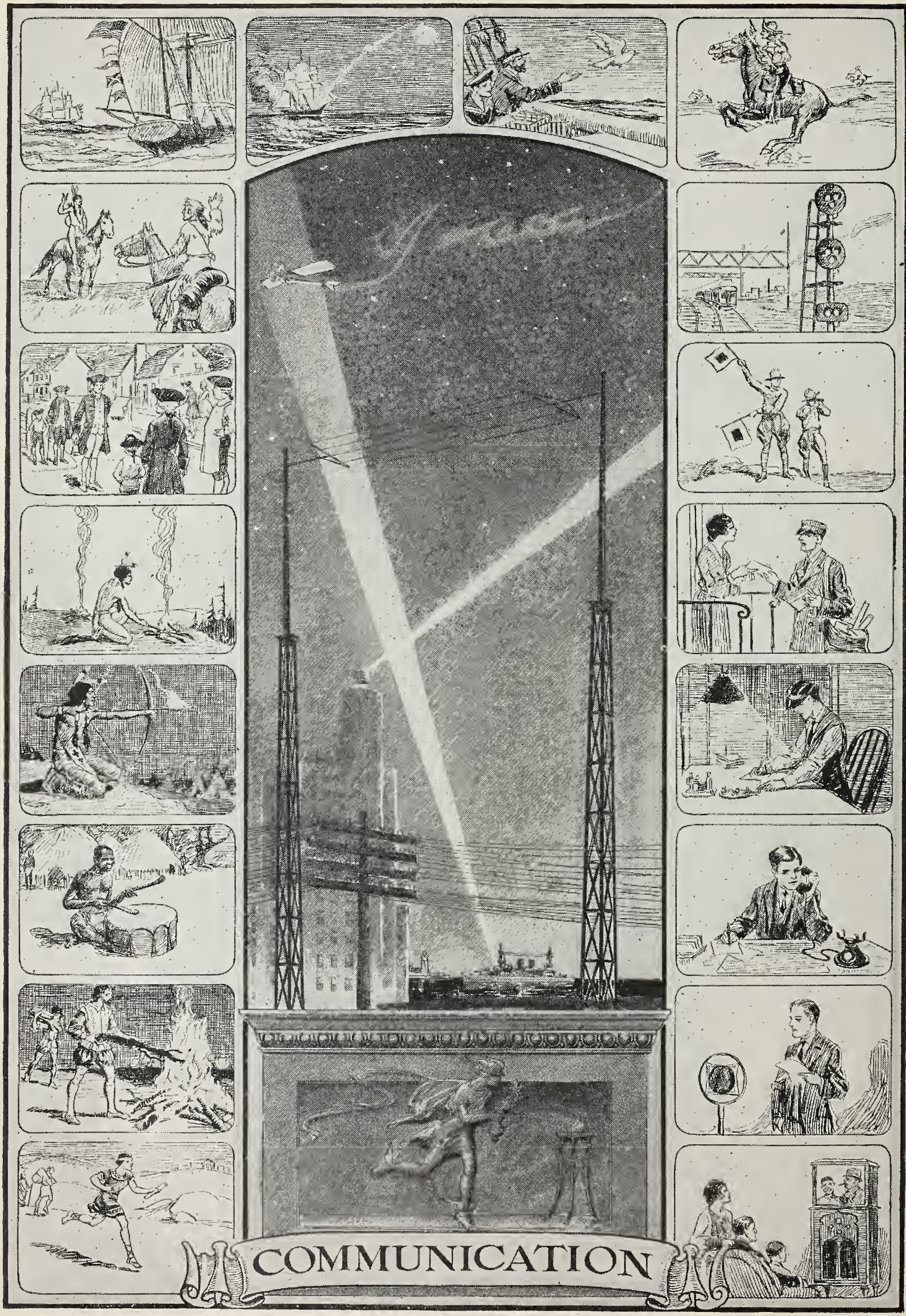


Fig. A. Tell something about each of the forms of communication which you see in these pictures.

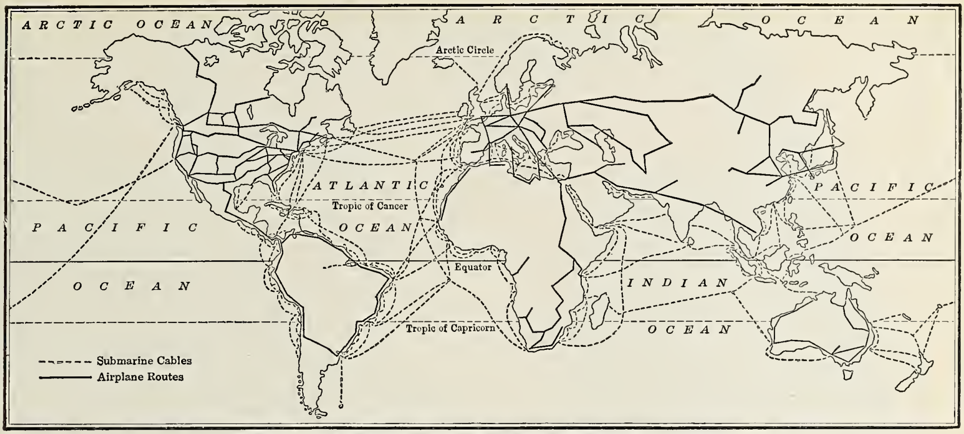


Fig. A. The chief ocean cables and air lines of the world.

Mount Vernon, near Washington, D. C.

Daily mail. Every reader of this book has seen mail which comes by train, by truck, by automobile, by airplane, or steamship. By these means mail is now carried daily to millions of homes in the United States, Europe, and to some countries in Asia, Africa, South America, and the islands of the sea.

Quick as lightning. Since Morse perfected the telegraph in 1844, messages traveling thousands of miles in a second can be sent by wire. The ocean cable invented by Cyrus Field has carried telegrams under the oceans since 1866. The telephone, invented by Alexander Graham Bell, in 1876, makes it possible for us to talk to distant people at any time of day or night. There are millions of telephones in use. They are an enormous convenience in business. People are constantly talking to one another from house to house, farm to farm, town to town, city to city, nation to nation. Then came the wireless telegraph invented by Marconi in 1896. This was soon followed by the radio, begun through the invention of the vacuum tube by De Forest, in 1906. I shall let you tell about the radio.

THINGS TO DO

Tell. Tell how things mentioned in this unit are used by the people in your neighborhood for business, for information, for recreation.

UNIT 5—THE TRADE OF THE WORLD

Why do men trade? Men trade because they have different kinds of goods and each wants what the other has. Among primitive men, for example, a fish net is exchanged for a bow and arrow; meat or skins for bananas or sweet potatoes. The Pygmies of Papua and many other primitive peoples exchange one article for another. Our ancestors did it for a long time. Many cities were first started by being temporary meeting places of people who wished to trade. This exchange of goods for goods is called *barter*. Long ago people began to use *money*, because money is so much more convenient than barter. By the use of money, we can buy the goods of people thousands of miles away without seeing them. In the same way people in other parts of the world can get goods from us. Barter makes people travel a great deal; money makes man a regular trader and go from customer to customer. In Europe there are many towns that have regular market days. Some have annual fairs.

Why do men have different kinds of goods? Men differ in their skills. Therefore they produce many different articles.

Make as long a list as you can of examples of trade that happens because of differences in the personal skill of workers.

Hints.—Germany, Paris, mass production.

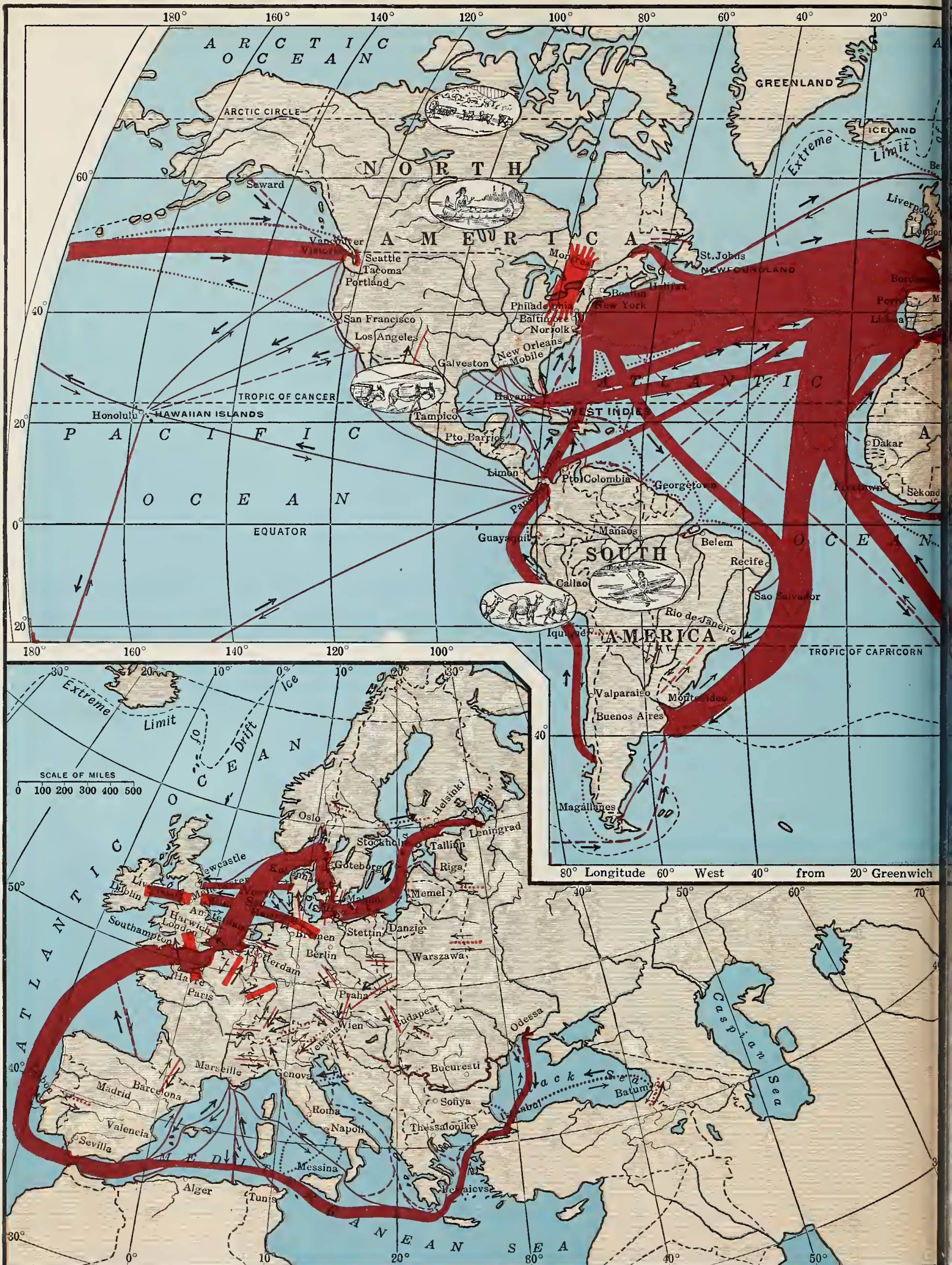

ARCTIC OCEAN
ARCTIC CIRCLE
GREENLAND
ICELAND
Extreme Limit
NORTH AMERICA
Seward
Vancouver
Victoria
Seattle
Tacoma
Portland
San Francisco
Los Angeles
Montreal
St. Johns
NEWFOUNDLAND
Halifax
Boston
New York
Philadelphia
Baltimore
Norfolk
New Orleans
Mobile
Galveston
Liverpool
London
Bordeaux
Lisboa
TROPIC OF CANCER
Honolulu
HAWAIIAN ISLANDS
Havana
Tampico
WEST INDIES
Pto. Barrios
Limon
Panama
Pto. Colombia
Georgetown
Dakar
Freetown
Sekondi
PACIFIC OCEAN
ATLANTIC OCEAN
EQUATOR
Guayaquil
Manaos
Belem
Recife
SOUTH AMERICA
Callao
Sao Salvador
Rio de Janeiro
Iquique
TROPIC OF CAPRICORN
Valparaiso
Montevideo
Buenos Aires
Magallanes
80° Longitude 60° West 40° from 20° Greenwich
SCALE OF MILES
0 100 200 300 400 500
Extreme Limit of Drift Ice
ATLANTIC OCEAN
Oslo
Helsinki
Leningrad
Stockholm
Tallinn
Riga
Goteborg
Memel
Newcastle
Dublin
Liverpool
Harwich
London
Southampton
Amsterdam
Bremen
Stettin
Danzig
Berlin
Warszawa
Rotterdam
Havre
Paris
Praha
Wien
Budapest
Venezia
Bucuresti
Odessa
Marseille
Genova
Madrid
Barcelona
Valencia
Sevilla
Roma
Napoli
Sofiya
Thessaloniki
Black Sea
Batum
Caspian Sea
Messina
Alger
Tunis
MEDITERRANEAN SEA

Fig. A. World trade. The amount of trade is indicated by the width of the red bands. Dotted lines indicate trade of minor importance. Dash lines indicate trade of moderate importance. See the trade arrows. The arrow from Canada into the United States is light; the arrow from the United States into Canada is bold. The bold arrows indicate a larger volume of trade than the light arrows.

Before you study this map compare it with the map showing density of population (Fig. 20-A). On Plate XVIII trace the caravan route from the city of Sian near the Hwang River in China, westward to Lanchow, Soochow, Hami, Kashgar, Samarkand, Bukhara, Merv, Meshed, Tehran, Tabriz, Trabzon. This camel journey has been made for ages, the camels picking their living as they went. But what of the cost? It took months of travel, hot and dusty or cold and dusty. Think of the *cost per ton mile*, and per ton for the whole journey.

Now remember that Kashgar and Samarkand and Meshed are oasis towns surrounded by hundreds of miles of scanty pasture and see how good an account you can give of the industries of this people and the goods they bought from foreign lands and the goods they sent to foreign lands.

Now do the same things for the industries and trade of Samarkand after the Russians built a railroad direct from Moskva (Moscow) and Leningrad. The freight rate was reduced to a cent and a half per pound.

Point out on this map some routes where the following articles are carried. Be sure you tell which way the article is moving and what the nation which buys it sends out as payment.

wheat	tires	bananas	furs
lumber	wool	oranges	steel rails
cotton	woolen cloth	raisins	machinery
phosphate	cameras	butter	coffee
petroleum	chemicals	mutton	spices
gasoline	iron ore	beef	canned fruit
rubber	tea	palm oil	

Fig. A. A New York company built these piers, freight sheds, and rows of fireproof factories just beyond them. Railroad cars and trucks run into the freight sheds, and right up to the doors of the factories. If you wish to manufacture something, a ship may unload a thousand raw materials in the freight shed; it will be manufactured across the street, and go to market by what three means of transport? ¶ A manufacturer can rent a room, a floor, a whole building. It will be heated, lighted, and electric power can be had by sticking a plug in the wall.

People who live in places with *different kinds of resources* have different products and wish to trade with each other. Make a list of examples of trade that arises:

1. Because of differences in climate in different places or different countries.

Collect your examples into groups. Each example in each group must be the *same kind of example*, but happening in a different place.

2. Because of differences in mineral resources.

Collect into groups as above.

3. Because of differences in the stage of *industrial* (manufacturing) *development*. For example, New Zealand and Montana produce wool, send it to Europe or to eastern United States, and in return buy woolen cloth, automobiles, and machinery. New Zealand and Montana both have coal and *might* make cloth, but their population is scanty and most of the workers are farmers.

Make groups:

1. A list of kinds of trade that must continue;
2. A list that should increase;
3. A list that may not increase.

Make lists of countries:

1. Which have small reason to trade with one another;
2. Which have great reason to trade with one another.

Pairs of cities and states. Do the same for cities as for countries. Do the same for states.

Future trade. If there is an increase in the trade of ———, what do you think will be the character of that trade? In the blank place write, in succession: Equatorial Forest Regions, the Tundra, Egypt, St. Lawrence Valley, Spring-Wheat Region of North America, Chicago, Florida, California, Japan. Add to the list; have your classmates do the same; then quiz one another.

CHAPTER SUMMARY

Some thought problems. 1. Does population density have any influence on commerce? Explain your answer. Give illustrations.

2. Does civilization increase cr decrease our dependence? Why?

Illustrations. Examine each of the illustrations in this chapter and tell what it shows about transport, the influence of transport, and its relation to possible trade.

Can you find. 1. How many miles are covered by air-mail service today?

2. The present airplane records for endurance, speed, and altitude?

Reports on communication:

1. The early telegraph
2. Laying the Atlantic cable
3. Alexander Bell and the telephone
4. The invention of the radio
5. Modern air-mail service
6. How the mail used to be carried
7. How newspapers collect and distribute news
8. Wireless telegraph
9. Television

77 bales Leather
2 cases Gelatin Dessert
178 cases Baking Powder
12 cases Quaker Oats
1 case Corn Meal
1 case Hominy
2 cases Flashlight Cells
2 cases Lubricating Machine Oil
1 carton Advertising Matter
25 bales Cotton Piece Goods
1 case Rubber Heels
13 bundles Machetes (long knives)
6 boxes Axes
2 cases Films
12 cartons Paste Shoe Polish
10 cases Oats
15 cartons Oats
31 cartons and bales Paper Bags
1 bale Gummed Tape in Rolls
26 bales Florida Water
1 case Flashlights and Batteries
3 bales Hair Tonic
1 bale Medicinal Soap
7 cartons Ice-Cream Powder
5 cartons Powdered Chocolate
1 carton Sweet Chocolate
5 cartons Breakfast Cereals
2 cases Breakfast Cereals
6 bundles Wall Board
1 case Cameras
1 case Films
10 cartons Candy
1 case Ice-Making Machines
1 case Toilet Preparations
1 bale Talcum Powder
2 cases Talcum Powder
1 case Glycerine
6 bundles Steel Bars
8 bundles Metal Lath
1 carton Fancy Soaps
1 case Fancy Soaps
4 bales Fancy Soaps
2 bales Dental Cream
25 cases Condensed Milk
2 cases Powdered Milk
10 cases Evaporated Milk
1 case Railway Parts
1 package Railway Parts
9 cartons Electric Bulbs
15 bales Dry Goods and Notions
1 drum Vaseline
1 case Hollow Ware
1 bale Paper
1 bale Colored Linens and Cottons
2 cases Soap
3 crates Straw Hats
1 bale Woolens
1 bale Bleached Cotton Handkerchiefs
1 case Yeast
30 bags Potatoes
21 bags Onions
3 cases Apples
3 crates Grapes
4 crates Lettuce
1 crate Celery
1 crate Carrots
1 bag Beets
1 bag Yellow Turnips
1 crate Cauliflower
2 cartons Cotton Umbrellas
1 box Cheese
1 case Ham and Bacon
1 case Sulphate of Quinine

Fig. A. Articles on the ship's manifest about which you will read on this page.

CHAPTER XXXVII

SOME NATIONS AND THEIR PLACE IN WORLD TRADE

THE HONDURAS TYPE. A few exports of tropic agricultural produce and many manufactured imports.

The trade of Honduras. We have learned that trade and transportation have developed from small and simple beginnings to large and far-reaching operations. But not all of the world's trade is thus enlarged and developed. Even the most primitive forms can still be found in some parts of the world. Indeed, nearly all forms exist in the small country of Honduras in Central America. In the tropic forests in the southeastern part of Honduras are Indians who know but little about the white man and his things. They live by hunting and fishing and by gathering wild things in the forest.

In another part of Honduras, on the high, cool plateau, live farmers who subsist almost completely on the produce of their own little farms and gardens. They sell little (chiefly coffee), and buy little.

On the northeastern coast conditions are different from the two types already mentioned. Here American companies have banana plantations that are thousands of acres in extent. These plantations employ hundreds and sometimes thousands of men. One March day a boat of one of the banana companies unloaded 55,000 bunches of bananas in New York. There was no other cargo except bananas. Three days later the boat started on the return trip. I was a passenger on it. I found that the ship carried the articles given in Figure 339-A. I copied the list from the ship's manifest, a

Fig. A. A new kind of trade in North America. Supplies and provisions for miners and prospectors in the Great North Woods are flown in by plane and then carried by dog sled.

paper kept by the purser, who is the person in charge of freight and other goods on the ship.

This variety of goods was all on one ship sailing to one small town. There was no railroad from it to the plateau, and journeys to the capital were usually taken by airplane. In the course of the year the variety of imports was much greater than this one cargo.

Seven eighths of all the *exports* of Honduras are bananas; coffee is second in value; and a half dozen other exports make up nearly all the rest.

Pick out from this list of exports to Honduras examples of different *reasons for trade* (page 338).

Does the list of exports show the effect of recent inventions in the United States upon our trade with Honduras? Think of the flashlight, for example.

Make a list of other countries whose trade should be much like that of Honduras. Group the countries by continents. Find them on Figure 2-A and Plate II.

Pick out some of our states and some Canadian provinces which you think have trade that resembles that of Honduras. Explain.

THINGS TO DO AND QUESTIONS TO ANSWER

Routes and trade. 1. From advertisements in magazines or the newspapers of some large seaport get the names of several steamship lines. Get their circulars and make sketch maps showing routes followed by their ships.

2. Examine carefully Figures 326-A and 336-A. What do you notice about the location of most of the two kinds of routes?

> THE TRADE OF THE UNITED STATES. A country with a great variety of resources and industries, exports, and imports.

A. Imports.

1. Examine the list of leading United States imports.

2. Make a list of industries that are aided by the imported materials.

Make a list of the states and cities that would be embarrassed if imports to the United States suddenly stopped.

What foreign countries would be in trouble if our imports stopped?

List the climatic regions of the world (Fig. 2-A). Can you find imports that come to us from each?

B. Exports.

1. Examine the list of countries to which we send large exports.

2. Tell what conditions in foreign countries will make those countries import more from us.

3. What would be the effect on our exports if:

a. Argentina opened a big oil field? (The examination of our trade with Canada and the United Kingdom, page 371, will help you to work out the answers to some of these questions.)

b. Brazil began to produce $100,000,000 worth of gold a year?

c. China began building 5000 miles of railroad a year?

d. China began building 5000 miles of good highway a year?

e. China began to manufacture twice as much cotton cloth as she now does and also to manufacture some machinery?

f. Germany had a financial panic?

g. Many Americans went to Europe for the summer?

h. Spain doubled her use of the telephone?

i. Italy or Sweden had a rapid increase in population?

j. South America doubled the number of newspapers?

k. The Amazon Valley developed a successful and large rubber industry?

l. Lake Tsana in Abyssinia had a dam built at its outlet and thus were turned into a reservoir to hold water to irrigate several million acres of land now arid in Sudan and Egypt?

m. There were a general increase of wages in Europe?

n. Great Britain doubled her exports of cotton manufactures?

C. List the climatic regions (page 2) and tell or write something about the possible importance or unimportance of each to the future trade of the United States.

1. Exports. 2. Imports.

D. Compare our foreign trade with that of

United Kingdom Brazil
Germany Canada

This can be done much better if you have the *Commerce Yearbook, Vol. II, Foreign Countries.*

In each case compare

1. The leading imports and the leading exports of the two countries being considered, and note the different character of trade of different countries.
2. The volume.
3. Relative size of imports and exports.
4. The trade per capita.
5. The countries with which it has the largest trade.

Competitive Countries and Complementary Countries.

Cuba produces sugar easily but cannot produce wheat. Canada produces wheat easily but cannot produce sugar so well. We say that these countries *complement* each other, which means that each produces what the other needs.

Make lists of countries that in some way complement each other.

Make lists of countries that are *rivals* or competitors, because they produce the same thing in such quantities that each wants to sell its surplus in foreign lands.

A Japanese foreign office official was reported as objecting to the United Kingdom's tariff policy against Japan. The official said that the export trade was a matter of life or death to Japan.

Can you explain his statement? The cottons and other goods made in Japan by people receiving twenty-five or thirty cents a day have taken many markets in Asia and Africa that were previously supplied by English workers who got a dollar or more

Fig. A. From this map what would you say of the possibilities of Switzerland for trade with western and central Europe?

a day in wages. The competition of Japan in foreign markets is something that you may watch with interest.

THINGS TO DO

Picture study. Examine Figure 232-A. Does the development and prosperity of this mine have any influence on American and European exports? Explain fully.

* The Denmark Type. A few exports, chiefly the product of intensive agriculture, imports of farm supplies, food supplies, and many manufactures.

The trade of Denmark. What is the density of population in Denmark? Do her imports and exports (page 367) show that Denmark is a country with many resources or few resources? How is this shown? Eighty per cent of the land is cultivated. What does that tell you about Denmark's lumber supply? What do her exports tell about her agriculture (page 115)?

What do the chief exports of Uruguay—wool, skins, live animals, beef, and mutton—tell about how the land is used in Uruguay? Compare the density of population in Denmark and Uruguay. Do you think the farms in the two countries differ?

* To study this unit and the following units in this chapter, you should have access to a copy of the *Commerce Yearbook, Vol. II, Foreign Countries.*

THINGS TO DO AND QUESTIONS TO ANSWER

Problems. 1. What countries do you think have trade much like that of Denmark? Tell why you think it is so.

2. Can you pick out parts of our own country that have trade much like that of Denmark? like that of Uruguay?

> THE SWITZERLAND TYPE. A country exporting many different kinds of fine manufactures and importing foodstuffs and raw materials.

The trade of Switzerland. Twenty-two per cent of this small country is waste. Of the usable area 29 per cent is in forest, 35 per cent in pasture, and 17 per cent in hay. This leaves only 19 per cent for cultivation, towns, and roads. Compare the population of Switzerland with that of Denmark in density per square mile; in density per *cultivated square mile.* What, in each country, is the main source of money for buying goods in foreign lands? What reasons can you advance for the great difference in the character of the foreign trade of these two small countries?

THINGS TO DO AND QUESTIONS TO ANSWER

Other Switzerlands. 1. Make a list of countries whose trade should be much like that of Switzerland. Group them by continents.

2. What parts of the United States should have a trade most nearly resembling that of Switzerland?

> STUDYING SOME OTHER COUNTRIES

Strong countries, weak countries. Some countries are strong and some are weak. Examine Table 57 (page 364), and pick out some of each and tell why you think they belong in one class or the other.

Trade relations. If you use your *Commerce Yearbook*, you can study the trade of some other countries to see what countries help them make a living by selling things to them and buying things from them.

The following countries will make interesting studies:

France	Lithuania
Belgium	Czechoslovakia
Japan	India
Spain	Chile
Germany	China

UNIT SUMMARY

A SUMMARY OF THE WORLD'S TRADE

Copy the following chart. If a country exports the commodity mentioned, color the square blue. If it imports the commodity mentioned, color the square red.

New Zealand	Australia	East Indies	China	India	South Africa	Egypt	U. S. S. R.	Rumania	Italy	Baltic countries	Germany	France	United Kingdom	Chile	Argentina	Brazil	Mexico	United States	Canada	
																				Iron ore
																				Coal
																				Lead
																				Copper
																				Zinc
																				Tin
																				Nitrate
																				Corn
																				Rice
																				Wheat
																				Rye
																				Barley
																				Oats
																				Potatoes
																				Cane sugar
																				Beet sugar
																				Coffee
																				Tea
																				Rubber
																				Silk
																				Cotton
																				Wool
																				Tobacco
																				Beef
																				Mutton
																				Pork
																				Lumber
																				Furs
																				Fish
																				Vegetable fibers
																				Clay products
																				Cotton cloth
																				Woolen cloth
																				Automobiles
																				Farm machinery
																				Chemicals

The Nations with Colonies. Why does no nation in the tropics have colonies?

The chief colonial nations are:

United Kingdom	Belgium
France	Japan
United States	Italy
Netherlands	

Study the United Kingdom and some of its colonies. Make a world map and put on it the British colonies. Then take sample colonies such as

A. Canada *B.* Jamaica *C.* Gold Coast

Make three lists of some other colonies of the United Kingdom, choosing those for each of the lists, A, B, and C, which have industries and trade somewhat like one of the three sample colonies. Tell how each colony is similar to the sample.

Find the area, population, population a square mile, leading industries, leading exports and imports of the sample colonies and of the mother country, proportion of the trade that is with the mother country. Compare the area and population of the colonies with those of the mother country.

In studying colonies and countries there are several things to keep in mind.

A. What the colonial nation does for the colonies. Something about most of the following subjects will be found in this book or in the other geographies you have studied. Perhaps you can find additional information in encyclopedias and other books.

1. Government
2. Capital and transportation
3. Leaders in industry
4. Education
5. Health: Is there a Board of Health where you live? What does it do? Does your state have a State Board of Health? What does it do? There is scarcely a country in the world that will allow a foreign ship to land without having a health officer visit the ship before it docks to see that its landing does not bring dangerous diseases ashore.

An annual report of the Rockefeller Foundation, New York, will tell many interesting things about the war against disease in many countries.

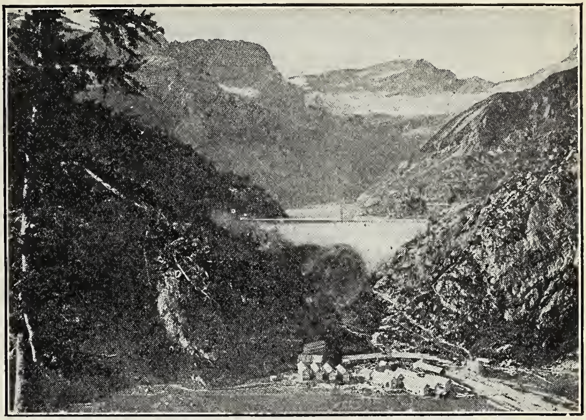


Fig. A. Find in this picture a concrete dam; an artificial lake. In the foreground are the buildings of a hydroelectric generating station in the Swiss Alps.

B. What the colonies do for the governing country:

1. Give markets
2. Give raw materials
3. Give opportunity for investment
4. Give jobs for people from governing country.

C. Climates of mother country and of colonies. Do the climates help trade; if so, why?

D. Education of people and their willingness to use science and machinery.

E. Undeveloped resources that may lead to settlement or trade.

F. What the people of the colonies think of being colonies.

Make a similar study of other colonial nations and their colonies.

THINGS TO DO AND THINK ABOUT

A map. On an outline map of the world mark plainly the following British ports: Gibraltar, Malta, Suez Canal (Britain has troops there), Aden, Colombo, Singapore, Hong Kong, Fremantle, Sydney, Wellington, Fiji, Samoa, Vancouver, Bathurst, Lagos, Capetown, Durban, Zanzibar, Bermuda, Kingston (Jamaica), Georgetown (Guiana), Port Stanley (Falkland Islands).

Compare. Compare the location of these stations for coal, oil, and ship repair, and the locations of the main trade routes on Figure 336-A. Would you say that the British had been preparing to be a maritime nation?

Extra credit. From encyclopedias, or other reference books in some library, find the story of the way some of the colonial powers have extended their territory.

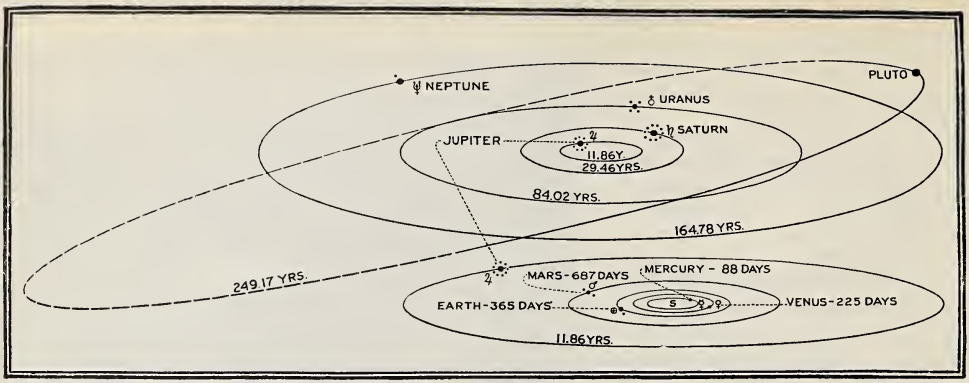


Fig. A. The sun, the nine large planets of the solar system, and their satellites.

CHAPTER XXXVIII

MATHEMATICAL GEOGRAPHY

THE EARTH AS A PLANET

Learn How. How does the mathematical geography which you will study in this chapter relate to your everyday experiences?

A huge body moving through space. We have studied about the various parts of the earth's surface as the homes of men, but we have not yet studied about this earth as a whole. There are many interesting things about the earth as one of the many huge bodies of matter moving around through space. The earth is one of several planets revolving around the sun. The sun is one of millions of stars giving heat and light.

Revolving around the sun. The planets revolve around the sun very much as a weight on a string revolves around your hand when you hold the string and swing the weight around and around. The time required for a complete revolution of the earth around the sun we call a year—365 days, 5 hours, 48 minutes, and 46 seconds. But because of the part of a day over 365 days, every fourth year is leap year. The leap year occurring every four years is a little too often (can you tell why?), so leap year skips three times every 400 years.

People once thought that sun, moon, and stars revolved around the earth, that the earth was flat and that you might fall off the edge of it. A learned Greek, Eratosthenes, 200 B. C. discovered by mathematics that the earth was round. This increased the desire to travel, but men dared not sail out into the open sea until they had a *compass* and a ship that could tack or sail into the wind. Columbus and other great sea explorers began their work soon after the ship was improved.

How long does it take the planet Neptune to revolve around the sun (Fig. 344-A)? What is the average distance of the earth from the sun? of Neptune?

The path, or orbit, of the earth around the sun, is not exactly a circle. It is an ellipse, or a circle that is flattened a little.

SOME SOLAR SYSTEM FACTS

	Mean Distance from Sun, Millions of Miles	Mean Diameter Miles	Number of Satellites
Sun	......	864,400	......
Mercury	36.0	3,000	0
Venus	67.2	7,700	0
Earth	92.9	7,918	1
Mars	141.5	4,340	2
Jupiter	483.3	88,400	9
Saturn	886.0	74,200	9
Uranus	1781.9	30,200	4
Neptune	2791.6	34,800	1
Pluto	3677.7	unknown	....

Satellites or moons. Some of the planets have smaller bodies, called *satellites*,

that revolve around them very much as the planets themselves revolve around the sun.

The earth has one satellite, the moon, which has about one fourth (0.27) as great a diameter as the earth, and is about 240,000 miles from the earth.

Astronomers, who have a very interesting time finding out things about the earth and the heavenly bodies, tell us that the moon has no air, and for that reason is colder than Greenland's ice cap.

The moon's phases—new moon and full moon. The part of the moon that is turned toward the sun shines with sunlight which is reflected to us as is the light from any distant hill. That is the reason we see the moon. The part that is turned away from the sun is in the dark, as the dark side of the earth is at night. (Fig. 345-B.) Look carefully at the new moon sometime; then tell yourself where the sun is at that moment, and you can see how it is shining on one side of the moon and not on the other.

Figure 345-A shows all this very well indeed. You can see that a person on the dark side of the earth (where it is night) would see more of the light side of the moon when it is at D than when it is at B.

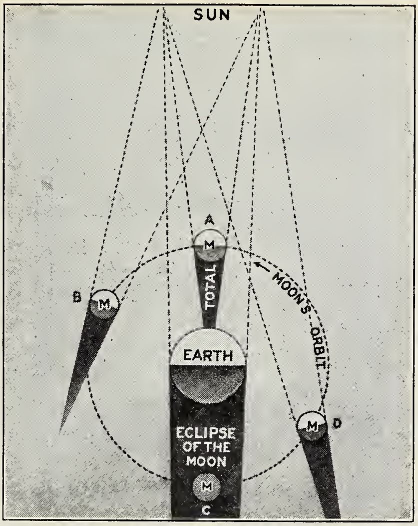


Fig. A. Position of moon, earth, and sun when we have eclipses.

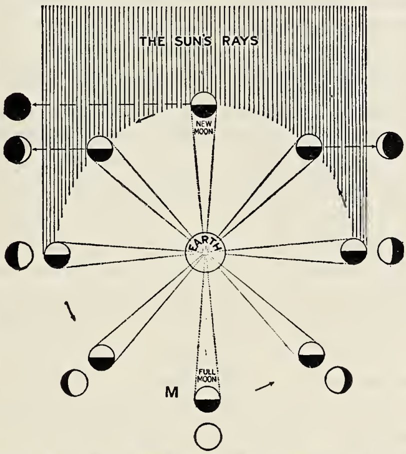


Fig. B. The phases of the moon. As the moon in its revolution about the earth every 29½ days moves through the first, second, third, and fourth "quarters" of its orbit, its form, or "phase," seems to change. The portion of the moon between the lines indicates the part opposite the eye of the observer on earth, the white, or illuminated, portion only of this part being visible. The white area of the outer circle of phases shows the moon as it appears to the observer at these phases and as it is usually represented.

Where should the moon be to show still more light?

The moon revolves around the earth every 29½ days. That is why we never see it in the same place two nights in succession.

Eclipses. Figure 345-A also shows how we have eclipses of the sun and moon. The very black parts in the picture are the shadows of the earth and the moon as the sun shines upon them. Sometimes, as the moon goes round and round the earth, it gets in between us and the sun, as at A on the figure, and hides the sun completely from a small part of the earth's surface—that part under the shadow marked "Total." We then have an eclipse of the sun. Now look at the figure, and explain for yourself what an eclipse of the moon is.

The moons, or satellites, of other planets. The table of solar-system facts shows that satellites are quite the style in the solar system, and that the earth is one of the poor brothers. Think what our night would be if we had as many reflectors as Jupiter!

Gravitation and tides. The heavenly bodies are pulling one another all the time. We call this pull *gravitation.* It is the gravitation

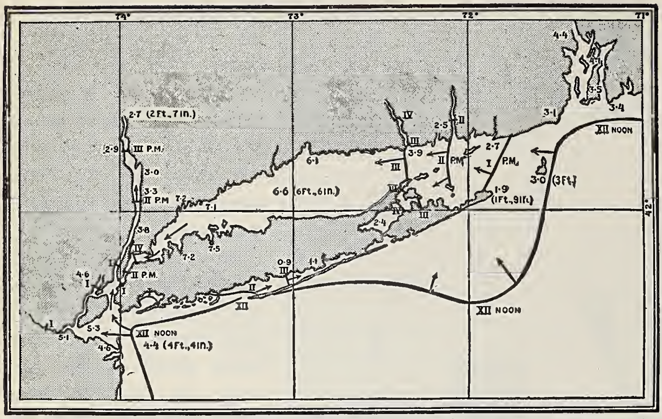


Fig. A. This map shows Long Island and vicinity with cotidal lines; that is, lines connecting points which have high tide at the same time.

of the earth for the stone that gives the stone weight. The earth and the moon pull each other all the time; and the sun and the earth pull each other all the time. Now one of the laws of gravitation is that its pull is harder on things that are near to each other than on things that are far apart. When it pulls the solid earth, the earth moves as one piece; so the center of pull is at the center of the earth's weight, or *center of gravity*, as it is called. That is somewhere near the center of the earth, about 4000 miles farther from the moon than is the surface of the earth. Because of this difference in distance, the moon pulls the sea water on the side of the earth nearest the moon farther than it pulls the earth. This makes the sea rise on the side toward the moon, and we call it *high tide.* But the water on the other side of the earth is 4000 miles farther away than the earth's center of gravity; so it is not pulled as much as the earth. That makes high tide on the other side of the world, too. Thus there are two high tides each day on our spinning world. One is on the part of the earth that is toward the moon, and one is on the part that is turned away from it.

Spring tides and neap tides. The pull of the sun also makes tides, and when the sun and moon pull together (position A in Fig. 345-A), tides are higher than common and are called *spring tides.* When they pull against each other (position B in Fig. 345-A) the tides are lower than common and are called *neap tides.*

Cotidal lines. In the open sea the high-tide wave runs around the earth following the moon. When it strikes the shores, its direction and speed are often changed by the shape of the land. The twelve o'clock line (XII noon) is close to the entrance of New York Bay and of Long Island Sound (Fig. 346-A). See how islands check its speed between one o'clock and four, especially in the bay at the eastern end of Long Island.

Notice that the East River, between Manhattan Island and Long Island, has tides running in from both the north and the south, and that the south tide (IV) gets there about two hours after the New York Bay tide (II P. M.).

Height of tides. The height of the tide depends upon the shape of the bay. Bays with narrow mouths have low tides and bays with wide mouths have higher tides. The Arabic figures (Fig. 346-A) show the one o'clock tide at the end of Long Island Sound to be only 1 ft. 9 in. How high is it near the west end of the sound? Low tide is called *ebb tide.*

In the East River, the tide from Long Island Sound is so much higher than the tide from New York Bay that water rushes through into New York Bay with a swift current (tidal race) so dangerous to ships that the early sailors called the entrance to the bay *Hell Gate.* See page 332 for tides and harbors.

We measure elevations on land from *sea level*—which is halfway between high and low tide.

Latitude and longitude. Suppose you

had a nice new baseball and knew that there was a nugget of gold hidden just beneath the cover in such a way that it could not be felt or seen. How would you tell anyone just where it was?

Now suppose you took a spot on the ball and called it North Pole, and another exactly on the other side and called it South Pole. Then suppose you drew a line from Pole to Pole and called it the first or prime meridian, or meridian of Greenwich, and then drew another line clear around the ball halfway between the Poles, and called it Equator. Now you could locate your nugget by saying that it was a certain distance on the North Pole (north) side of the Equator and a certain distance on the left (west) or right (east) side of the prime meridian. (Fig. 347-A.)

That is the way geographers locate places on the earth's surface. Instead of saying a place is so many miles north or south of the Equator, or east or west of the prime meridian, they use a fraction of the distance around the earth. For a long time mathematicians have divided circles into 360 equal parts called *degrees*. Thus a quarter of a pie is 90 degrees along the edge of the crust, and a quarter of the way around the earth is 90 degrees.

The geographer locates Cairo, Egypt, by saying it is on a meridian 31 degrees east of the prime meridian and 30 degrees north of the Equator, on a line parallel to the Equator called a *parallel of latitude*. Find Cairo in Figure 347-A. Geographers use the meridian that passes through the observatory of Greenwich (a part of London) as the prime meridian, and measure distance east and west of that in *degrees of longitude*, and distances north and south of the Equator in *degrees of latitude*. For more exact locations each degree is divided into 60 minutes and each minute into 60 seconds.

Degrees differ greatly in length. You can quickly see that $\frac{1}{360}$ of the distance around the earth at the Equator, where it is large, will be much more than $\frac{1}{360}$ of the distance around the earth near the Pole. For exact lengths of degrees of longitude at different distances from the Equator, see the table. Degrees of latitude are almost the same length everywhere, about 69 miles. Places near the Equator are in *low latitude*. Those near the Poles are *high latitude*.

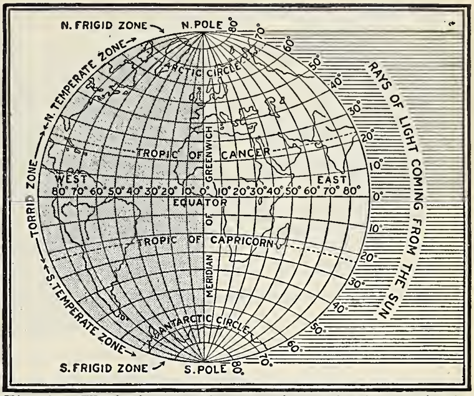


Fig. A. Half of the globe, showing latitude, longitude, day and night, the sunrise line, and the zones. Other names given to the zones are *Polar*, *Intermediate*, and *Equatorial*. Find each on the globe.

LENGTHS OF DEGREES OF LONGITUDE AND OF THE DAY ON CERTAIN PARALLELS

At Latitude (degrees)	Numbers of Hours or Days of Sunshine—Longest Day	Statute Miles
0	12h 08m	69.172
10	12h 43m	68.129
20	13h 21m	65.026
30	14h 05m	59.956
40	15h 01m	53.063
50	16h 23m	44.552
60	18h 53m	34.674
70	73 days	23.729
80	138 days	12.051
90	192 days	0.000

The shape of the earth. We say the earth is round like a ball; but it is not exactly round. Actually, it is slightly flattened because it spins so fast. The other planets are also flattened a little for the same reason. The earth turns round an imaginary central line called the axis, of which one end is the North Pole and the other end is the South Pole. It is so nearly round that the polar diameter (distance through the earth from Pole to Pole) is 7899.4 miles, while the equatorial diameter

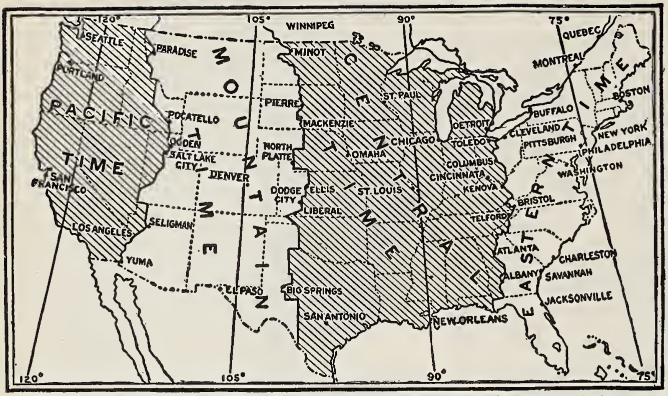


Fig. A. Map of the United States showing belts of standard time.

is 7926.7. Can you calculate the circumference at different latitudes? See the table. We know that the earth is round because we travel around it, and ships sailing away from us at sea go down gradually behind the horizon. The horizon at sea is circular; the shadow of the earth on the moon is circular. At different latitudes we see different stars.

Keeping time. Figure 347-A also shows us something about how we count time. The earth rotates on its axis from west to east, and every time it goes around once we are turned toward the sun (light) and away from the sun (dark) we call it a day, divided into 24 hours. In Figure 347-A we see at the right the rays of the sun, which are always lighting up one half of the earth and leaving the other half in shadow. In this figure the Greenwich meridian is the shadow line, or sunrise line. Therefore it is sunrise at Greenwich, and since the sun shines on both Poles we know (Fig. 25-A) that it is about March 21 or September 21.

At noon the sun is at its highest point and shadows are then the shortest for that particular day. At that moment, the middle of the day, the sun is directly south of us.

How fast does sunrise travel? In 24 hours it goes round the earth, 360 degrees. In one hour it therefore goes 15 degrees. How long does it take to go one degree?

Standard time. How shall we keep time on this whirling globe where the sunrise and noon travel westward many miles a minute? How many miles a minute? Since we have the habit of meeting trains, we need to agree on how we shall set our clocks. For convenience we divide the United States into bands or belts (Fig. 348-A) about 15 degrees wide. In the eastern belt everybody keeps 75th meridian time. In the central belt everybody keeps 90th meridian time. The line between the belts is irregular because it would be very inconvenient for the conductor of a train to change his time a few miles outside of a city like Columbus, Ohio, or Salt Lake City, Utah. Therefore we zigzag the edges for the sake of convenience. Every time a traveler going west crosses into a new time belt, he sets his watch backward one hour. If he goes eastward, he sets it forward one hour.

International date line. Suppose he went westward clear around the earth, setting his watch back an hour every fifteen degrees. When he reached home, he would be one day behind the calendars of the home folks. Those twenty-four hours that he had lost by moving his watch back would have taken a day, and he would therefore say it was Saturday when it was really Sunday. To avoid this trouble, men have made an international date line out in the Pacific Ocean where it will make the least trouble. Every time you cross that line you move your calendar backward or forward one day. In my diary going west to Japan I have this entry, "Thursday, *the day that was not.* We crossed 180° in the evening of Wednesday and accordingly waked up on Friday the next morning." The international date line zigzags a little for the same reason that our time-belt lines do.

Change of seasons. To understand our change of seasons, do the following: On a sheet of paper mark a place near the center and call it sun. Around this draw a line to show the path of the earth. Now stick a pin into the paper somewhere in your path of the earth. This pin represents the earth's axis. The flat sheet of paper represents the plane of the earth's path or orbit. The axis of the earth points to the same place in the sky all the time, and it is not perpendicular to the plane of the orbit. It is inclined $23\frac{1}{2}$ degrees away from the perpendicular. Look at Figure 25-A and see that the axis is slanting. Remember that the earth goes clear around the sun, and you can see that the North Pole is in darkness when it is inclined away from the sun during northern winter. On December 21 or 22, our shortest day, the sun shines on the surface of the earth no farther north than the place marked by the Arctic Circle. At that time a place just south of the Arctic Circle has only a few minutes of sunshine each day, and places inside the Arctic Circle have many days with no sun at all.

When the earth is on the other side of the sun, June 21 or 22, the North Pole (Fig. 25-A) is inclined toward the sun, and the sun shines clear across it to the Arctic Circle on the other side. At this time a place just south of the Arctic Circle has only a few minutes daily when the sun cannot be seen, and places north of the Arctic Circle have many days when the sun does not set at all. This makes the Arctic tundra produce grass and many blooming plants. The Antarctic Circle is $23\frac{1}{2}$ degrees from the South Pole; the Arctic Circle the same distance from the North Pole.

The Tropic of Cancer, $23\frac{1}{2}$ degrees from the Equator, is the most northerly place on which the sun's rays fall perpendicularly in June. The Tropic of Capricorn is the same distance south of the Equator. Can you tell why?

Equinox. About March twenty-first and September twenty-first the sun shines on both Poles (Fig. 25-A). The days and nights are everywhere of equal length, and for that reason we say it is *equinox*.

The zones. Geographers have divided the earth into belts called zones (Fig. 347-A) because of the differences in sunshine at different seasons. The zone along the Equator between the Tropics of Cancer and Capricorn is called the *Torrid* Zone because of its heat. Around each Pole there is a *Frigid* Zone, so named because of its cold. The Arctic Circle bounds the northern, and the Antarctic Circle the southern Frigid Zone. Between each Frigid and the Torrid Zone there is a *Temperate* Zone, so called because its average temperature is between that of the Torrid and that of the Frigid Zones. Find all the zones on Figures 25-A and 347-A. In which zone do you live? In which zone is it winter when we have summer?

The wind systems of the world. Examine the drawing (Fig. 26-B) carefully, and you will see that at the Equator, where the air is very hot and therefore light, it is ascending. (See edges of drawing.) At high elevations it turns and travels back toward the Poles, while surface winds, the trade winds, flow toward the Equator to take its place. How many miles is it around the earth at 0° lat.? at 30° lat. (page 347)? When the slow-moving air at 30° starts toward the Equator it falls behind as does a man who steps onto a vehicle that is moving faster than he is. Therefore the north*east* and south*east* trade winds.

Just north of the Tropic of Cancer and again south of the Tropic of Capricorn is a region of descending air where there is so little wind that sailing vessels sometimes have trouble to sail along. Sailors call these places the *horse-latitude calms*.

North of the northern horse latitudes and south of the southern horse latitudes the wind blows from the west so much of the time that these zones are called the *prevailing westerlies*. It is hard for the people who live in the midst of these winds to understand that they are in the zone of the

Fig. A. If the paper cover of your school globe were removed carefully, the continents would appear as on this drawing. Now pretend that you can straighten each meridian and you have Mercator's projection as shown in Figure 350-B.

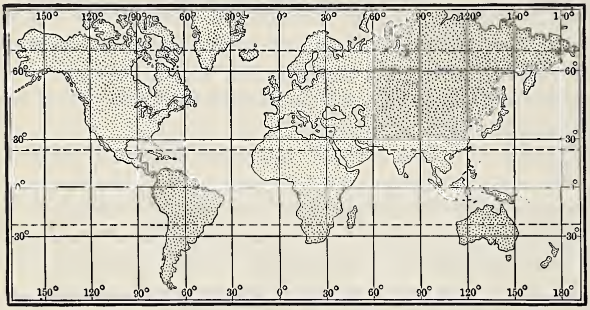


Fig. B. In 1569 Gerardus Mercator, a Flemish geographer, published the first map on "Mercator's projection" with parallels and meridians at right angles to each other. You can see by referring to Figure 350-A that Mercator's projection shows northern North America much wider than it should be. Greenland (827,000 square miles) appears to be larger than South America (7,073,000 square miles).

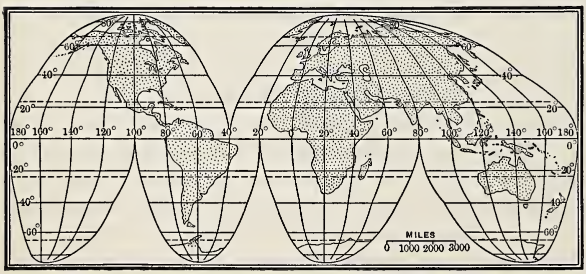


Fig. C. The "homolographic projection" of John Paul Goode, 1916. Look at Fig. 350-A and pretend you have pinched each continent together so that its parts join. That is what Doctor Goode did to make this map. The shapes of the continents and their relative sizes are much more accurate on this projection than on Mercator's.

westerlies because of the great eddies or cyclones, several hundreds of miles across, that come along every few days. One of these cyclones is shown in the westerly wind zone of the Northern Hemisphere (Fig. 78-A). It travels along with the westerly winds, but around its center the wind is blowing in all directions. For a full account of the cyclones see pages 80 to 86, and of the trade winds, page 27.

Ocean currents. As wind blows over water, it rubs against the surface. This rubbing or friction draws the water along with the wind. Thus the ocean has currents. Look at Figure 352-A. What direction have the currents in the Atlantic and Pacific Oceans where the prevailing westerlies blow? where the trade winds blow? The currents in the Indian Ocean north of the Equator flow one way in winter and another in summer. Examine Figures 22-A and 23-A and see if you cannot explain why these currents thus change.

How do the North Atlantic and North Pacific currents help you understand why the climate is so much alike on the eastern edges of the two oceans and also on their western edges?

Maps. Long, long ago someone took a stick and made marks on the ground to show the way to a certain place. That was probably the first map. We now have many kinds of maps.

The globe. As the earth is round, the globe is the best map because it is the same shape as the earth. Be sure to examine one carefully even if it is only a ten-cent-store globe.

Figure 350-A shows us the problem we have in trying to show the surface of a round globe on a flat surface.

Figure 350-C shows how one map maker

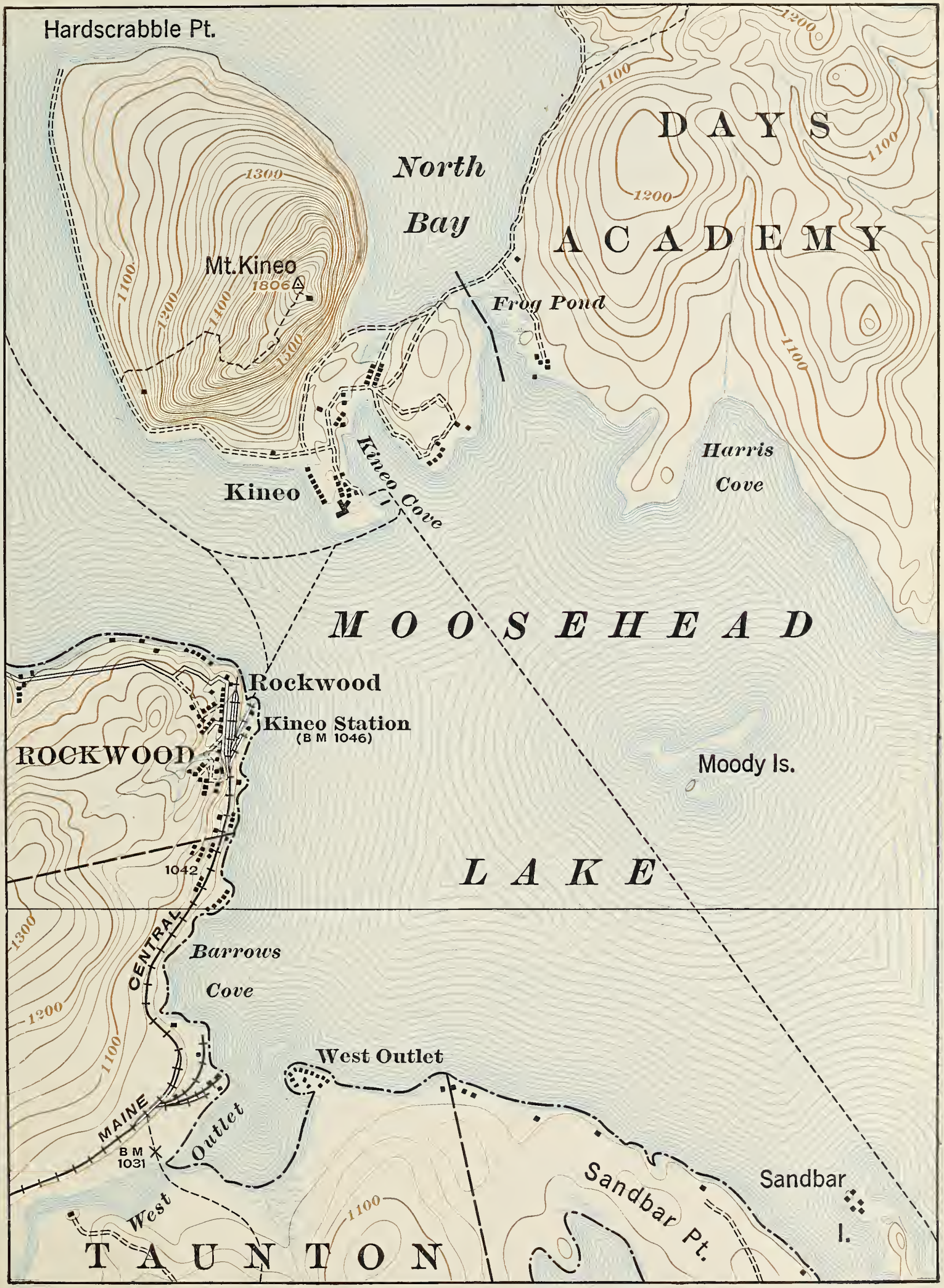


Fig. A. This map shows *relief* or *elevation* by use of *contour lines*. See page 353 for questions on the map.

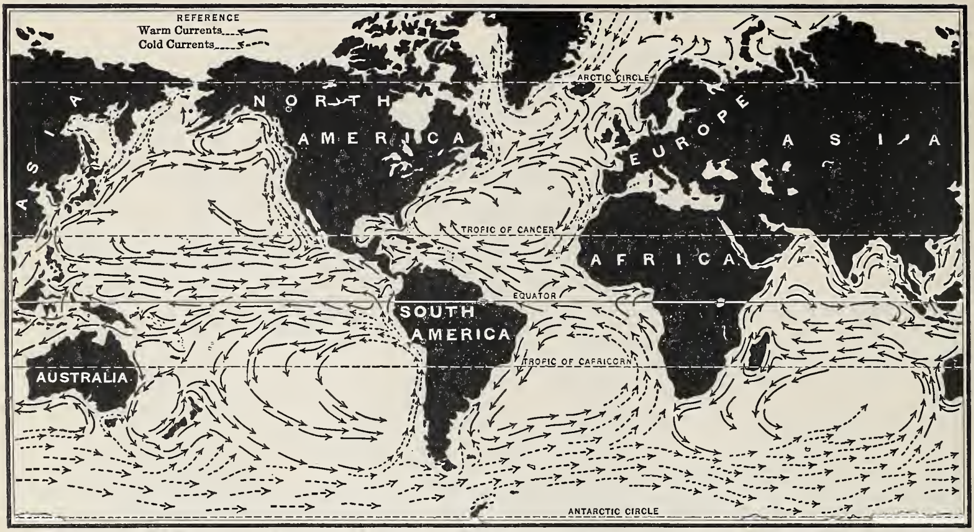


Fig. A. The courses of the ocean currents. What two kinds of currents are shown on this map?

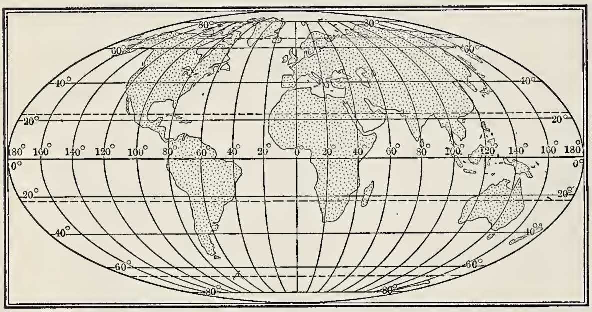


Fig. B. In 1805 Mollweide published a map of the world on which the meridians are ellipses. The shapes and relative sizes of the continents are more nearly accurate than Mercator's but less accurate than Goode's.

does it. Figure 350-A helps us to understand the Mercator map. Figure 352-B shows another method or map *projection* as it is called.

Political maps. Political maps show *countries* and cities, things that man has made (Plate II).

Physical maps. Physical maps emphasize the things nature has made—temperature (Fig. 27-A), rainfall (Fig. 22-A), ocean currents (Fig. 352-A), winds (Figs. 23-A and 83-B).

One way of showing physical features is by color. Look at Plate IX and tell what every color means. Another way of showing elevations is by little straight lines called *hachures* (Fig. 353-A).

A better way of showing elevation is by lines called *contour* lines (Fig. 351-A).

We have many other kinds of maps in this book: population (Fig. 20-A), products (Fig. 63-A), trade (Figs. 329-A and 336-A), and climatic regions (Fig. 2-A).

Scale. You probably know what scale is on a map, but if you do not, you can quickly learn by making a plan of your schoolroom, or your home, or a baseball diamond, using $\frac{1}{4}$ inch of paper for 1 foot of length. Make a second plan using $\frac{1}{8}$ inch to the foot. The larger the area shown on a page the smaller the scale must be. Pick out large-scale and small-scale maps in this book.

THINGS TO DO AND QUESTIONS TO ANSWER

1. Is night an advantage or a disadvantage to man?

2. Why do we count the beginning of a new day at midnight rather than at noonday?

3. The moon always has the same side toward

the earth. Would you like to have the same side of the earth always turned toward the sun? Why?

4. With the sun directly overhead at the Tropic of Cancer where would one find the longest period of sunlight? the shortest? Use the globe.

5. At which place is the succession of day and night more favorable to man's activities, at Etah, Greenland, or at New York City?

6. What is the relation of the slant of the sun's rays to the intensity of its heating effect upon a given area?

7. Compare the total amount of sunlight received during a year at a point on the Equator and at either one of the Poles.

8. In what latitudes do the highest civilizations seem to be found? Account for this fact.

9. Why do birds migrate northward and southward rather than eastward and westward?

10. On any given evening in summer could you read later without artificial light, near the Peace River, Canada, or in New York City? Explain.

11. What is meant by "the land of the midnight sun"? Is northern Alaska such a land?

12. How may you determine your latitude by observing the position of the North Star?

13. What season of the year do the people of New York State have when those of Argentina have summer?

14. Why must a person change his watch at intervals on traveling east or west, while he does not need to do so on traveling north or south?

15. Which of two places is farther east at any moment, the one having 8 a. m. or the one having 10 a. m. solar time?

16. What is the difference in longitude between two places which have a difference in time of four hours?

17. A man travels around the earth without changing his watch. He observes from day to day that it seems to be losing time. How much will it appear to have lost by the time he reached home? In which direction is he traveling?

18. A man in New York City has a birthday on June 20th. At 6 p. m. he receives greetings by radio from a friend in Sydney, Australia. What is the date and the time of day for the man sending the message?

19. A man in Cairo, Egypt, wants to cable a night letter to reach his daughter in Chicago about 9 a. m. on Tuesday. At what time should he leave the message at the Cairo office, allowing no time for transmission?

Studying the contour map, Figure 351-A. 1. You can see near the top of the map the figures 1100 and 1200. That means that the lines on which they stand are 1100 feet and 1200 feet above sea level. Between the lines on which these figures stand there are four lighter lines and five spaces. What is the elevation of each of these four lines? What is the elevation of the first line above the shore of the lake? Then what is the elevation of the lake?

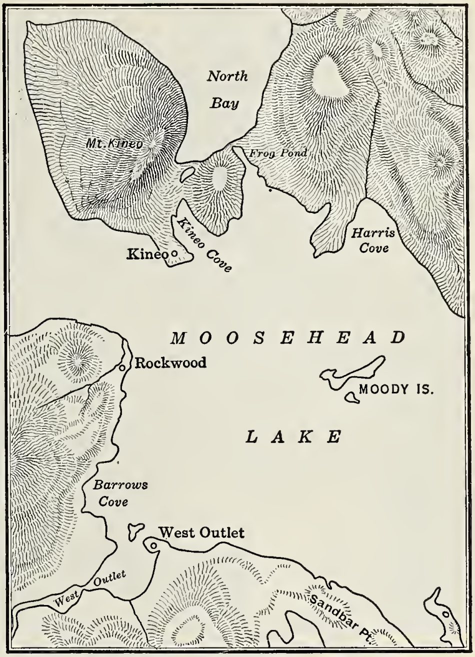


Fig. A. The Moosehead Lake area in Maine shown on page 351. Elevation and slope are shown here by lines called *hachures.*

2. How high are the three highest places near the northeastern part of the map?

3. Suppose you were on a steamboat coming along the dotted line from the southeast. Just as you enter Kineo Cove you look in the direction of North Bay. Can you see all of North Bay? How high is the hill between you and North Bay? How high is the road between Kinec Cove and North Bay? Which of the two hills that face North Bay is the steeper? How does the map tell you the answer to that question? How high is the top of each of these hills?

4. Point out some places where you see long stretches of good road that do not climb hills. Find some that do climb hills.

5. Point out marsh, island, stream, small lake, peninsula, isthmus, a gentle slope, some land that is nearly level, some land that seems to be inhabited (the black squares are houses), some land that does not appear to be inhabited.

Fig. A. Photograph of a relief model of Washington. Elevation is shown by light and shade.

STATISTICAL TABLES

We come now to pages and pages of figures, often called statistics. Do not be alarmed. You will not have to learn to remember all these figures.

Why were they put into the book? Well, a table of figures is often the quickest way in which you can tell something. Look for a moment at the table numbered 1, about sheep. It tells you that Texas has eighty-one hundred thousand (eight million one hundred thousand) sheep. It tells you also that Texas is the first state in sheep, and that it has nearly twice as many as the state that is second. Now see how quickly the column of figures tells you these things. It also tells you many more things. Do not add up the figures and expect to get the total that is at the bottom. The table shows the number of sheep in the *leading* states, and then the total gives the figure for the *whole United States.*

Some of the tables will not total up exactly because we use round numbers; thus 4,080,203 becomes 41 hundred thousand, and 4,130,204 becomes 41 hundred thousand.

Here is an interesting thing to do. Get the *Yearbook of the United States Department of Agriculture*, look up sheep in the index, and see what changes have taken place in recent years.

If you want to see how much a table of statistics can tell in a short space turn to page 364 (Table 57). Look up Italy. How many cattle are there per person? How many in Argentina? Compare Italy and Great Britain in coal mined per person. How many people does Italy have for one telephone instrument? How many in the United States? How many ton-miles of freight are moved in a year for one Italian? for one citizen of the United States?

By the time you have read all the things that this table tells about a country and its neighbors you are almost ready to write a composition about the country.

You can easily see that this table of *figures* gives you many *ideas.*

STATISTICAL APPENDIX

1. SHEEP IN LEADING STATES OF THE UNITED STATES*

State	100,000
Texas	81
Montana	41
Wyoming	36
Colorado	30
California	28
New Mexico	27
Idaho	23
Oregon	23
Utah	22
Ohio	21
United States (total all states)	533

* The *Yearbook* of the United States Department of Agriculture has a great variety of agricultural statistics, of which this table is a sample.

2. WATER-BORNE LUMBER SHIPMENTS FROM PACIFIC COAST*

Destination	From Washington and Oregon		From British Columbia	
	1928	1932	1928	1932
Atlantic coast of United States	1,682	724	282	39
California	1,505	512	37	10
Hawaiian Islands	76	46	...	...
Other domestic	33	32	65	31
Total domestic	3,296	1,314	384	80
Foreign countries	1,630	537	382	367
Grand total	4,926	1,851	766	447

* Millions of board feet.

3. PULP-WOOD PRODUCTION AND CONSUMPTION IN UNITED STATES

State	Production (1,000 tons)	Consumption (1,000 cords)
Maine	981	1,312
Wisconsin	734	1,234
New York	663	826
Washington	524	956
Louisiana	246	460
Pennsylvania	213	398
Virginia	206	375
New Hampshire	213	376
Minnesota	190	266
Michigan	178	313
Other states	715	1,129
United States (total)	4,863	7,645

4. SHEEP IN LEADING SHEEP-PRODUCING COUNTRIES

Country	100,000
Australia	1,106
U. S. S. R. (Russia)	795
United States	533
Union of South Africa	487
Argentina	444
India	443
New Zealand	286
United Kingdom	271
Spain	200
Uruguay	154

5. PRINCIPAL MATERIALS CONSUMED IN PAPER INDUSTRY IN UNITED STATES

Kind	1,000 tons
Wood pulp	6,289
Paper stock (old paper)	3,842
Rags	739
Straw	575
Clay	471
Manila stock (rope, jute, bagging, etc.)	129
Rosin sizing and rosin	137
Casein	18

6. UNITED STATES EXPORTS OF LUMBER TO LEADING IMPORTING COUNTRIES

(Thousands of dollars)

Country	1932	1928	1914
United Kingdom	$8,804	$24,035	$9,990
Japan	2,462	15,844	.....
Argentina	2,004	10,481	2,148
Canada	1,696	11,459	7,878
Belgium	1,299	......	1,370
Italy	1,217	......	.....
Netherlands	1,202	5,272	2,488
Australia	333	6,062	4,219

7. WINTER- AND SPRING-WHEAT PRODUCTION

(Million bushels)

3-Year Average	United States		Canada	
	Winter Wheat	Spring Wheat	Winter Wheat	Spring Wheat
1909–1911	428	219	23	158
1919–1921	655	204	14	235
1929–1931	655	202	19	324

8. GRAIN AND POTATO PRODUCTION IN SELECTED COUNTRIES
(In million bushels)

Country	Corn	Wheat	Oats	Rye	Barley	Rice	Total Grain	Bushels Grain per Capita	Potatoes	Bushels Potatoes per Capita	Bushels Potatoes per Acre
United States	2,387	857	1,171	37	261	44	4,757	38.7	346	2.8	110.8
Canada	5	343	366	14	102	....	830	83.5	78	7.9	137.5
Irish Free State	....	1	43	....	5	....	49	16.8	91	30.8	256.4
Italy	98	238	42	7	11	32	428	10.4	73	1.8	79.7
Switzerland	....	4	3	2	....	....	8	2.1	27	6.6	229.4
Germany	....	139	442	295	139	....	1,015	15.8	1,605	25.0	230.3
Denmark	....	11	68	10	48	....	136	38.5	36	10.1	223.7
Norway	....	1	12	....	5	....	18	6.2	30	10.6	251.0
Bulgaria	34	51	9	11	15	1	120	20.2	2	0.4	....
Rumania	223	122	73	15	100	....	531	29.6	79	4.4	119.8
Hungary	62	78	20	27	30	....	213	24.6	67	7.7	95.8
Poland	4	77	175	258	70	....	584	18.8	1,147	36.8	173.6
Lithuania	....	10	28	21	11	....	71	29.9	70	29.7	172.0
Latvia	....	3	24	10	9	....	46	24.0	41	21.6	160.5
Estonia	....	2	11	7	6	....	25	22.4	30	27.1	173.5
Finland	....	1	41	12	7	....	61	16.7	28	7.7	160.1
Argentina	328	205	66	6	17	....	623	54.3	37	3.2	100.4
Japan	3	30	12	....	76	536	657	10.2	35	0.6	97.5
Australia	8	177	20	....	7	1	213	32.9	12	1.9	95.1
New Zealand	....	7	4	....	....	....	11	7.5	5	3.3	140.0

9. WHEAT YIELD PER ACRE AND PRODUCTION, FOR SELECTED STATES AND COUNTRIES
(Production in million bushels; yield in bushels per acre)

State or Country		1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
New York	Production	9	8	8	7	6	6	5	6	5	4	4	5
	Yield	20.7	18.7	19.4	20.3	18.0	19.5	17.5	20.9	14.9	16.0	18.2	25.2
North Dakota	Production	86	88	130	69	133	114	78	134	155	100	108	40
	Yield	8.8	8.2	13.8	8.2	15.3	12.3	8.6	12.9	14.4	9.6	11.0	6.4
Manitoba	Production	38	39	60	33	41	34	47	31	52	29	44	27
	Yield	13.9	11.2	19.3	11.3	16.9	17.7	22.6	14.0	19.7	12.4	17.7	10.5
Kansas	Production	145	134	125	84	157	81	154	114	184	149	167	240
	Yield	15.6	12.7	12.8	10.1	16.0	9.2	14.8	11.2	17.0	12.3	13.5	19.0
Georgia	Production	1.0	1.2	1.1	1.3	0.6	0.6	1.0	0.7	0.5	0.4	0.3	0.6
	Yield	8.1	9.0	6.5	7.5	8.1	8.0	12.0	7.5	9.0	8.5	10.5	13.0
Washington	Production	40	50	28	51	25	34	38	53	46	43	38	41
	Yield	17.2	23.2	13.6	25.3	14.1	17.5	19.1	24.6	21.4	18.6	16.6	17.3
United States	Production	843	819	847	759	840	669	834	875	926	813	857	900
	Yield	13.5	12.7	13.8	13.3	16.0	12.8	14.7	14.7	15.6	13.0	14.0	16.3
Canada	Production	263	301	400	474	262	395	407	480	567	305	421	304
	Yield	14.5	13.0	17.8	21.7	11.9	19.0	17.8	21.4	23.5	12.1	16.9	11.6
England	Production	52	69	61	56	50	50	48	52	47	47	39	35
	Yield	28.6	35.6	31.9	32.7	33.0	34.0	30.6	32.5	34.0	29.7	29.7	30.1
France	Production	237	323	243	276	281	330	232	276	281	337	228	264
	Yield	18.8	24.3	18.6	20.2	20.6	23.8	17.9	21.1	21.7	25.3	17.2	20.6
Belgium	Production	10	15	11	13	13	14	13	16	17	13	13	14
	Yield	33.6	42.3	35.4	38.4	38.2	39.7	36.2	41.6	42.2	37.1	32.2	36.3
Rumania	Production	61	79	92	102	70	105	111	97	116	100	131	135
	Yield	12.3	12.8	14.1	15.4	9.0	12.8	13.5	12.6	14.6	14.7	17.3	15.8
India	Production	378	250	367	372	361	331	325	335	291	321	391	347
	Yield	12.6	9.7	13.1	12.1	11.6	10.4	10.7	10.7	9.0	10.0	12.3	10.8
Argentina	Production	156	191	196	248	191	191	221	239	345	163	232	220
	Yield	10.4	13.4	12.0	14.4	10.7	10.0	11.5	12.1	15.6	10.2	11.8	13.7

10. NET EXPORTS OF LIVE ANIMALS FROM THE NETHERLANDS

Year	Cattle	Calves	Pigs
1929	17,095	18,509	28,039
1931	14,964	7,554	17,357

11. NET IMPORTS OF GRAIN AND OIL CAKE INTO THE NETHERLANDS
(Grain in million bushels; Oil Cake in tons)

Wheat	Rye	Maize	Oats	Barley	Oil Cake
27.3	8.6	61.5	8.3	24.8	299,233

12. EXPORTS OF UNITED STATES AND CANADIAN WHEAT
(Thousand bushels)

	United States Wheat	Canada Wheat
United States ports:		
Galveston	25,580	......
Oregon	18,667	......
New Orleans	7,794	......
New York	4,854	56,077
Washington (state)	4,462	......
Baltimore	2,225	6,534
Virginia	1,030	78
Philadelphia	843	4,669
Massachusetts	257	2,780
Portland	......	749
Canada Atlantic:		
Montreal	18,545	38,962
Quebec	......	4,359
Sorel	255	3,499
St. John	5,394	9,354
Halifax	130	10
Canada Pacific:		
Vancouver	......	72,279
Prince Rupert	......	1,255
Victoria	......	947

13. NUMBER OF ANIMALS SLAUGHTERED IN THE LEADING PACKING CENTERS
(In thousands)

City or Country	All Animals	Cattle and Calves	Sheep and Lambs	Swine
Chicago	11,654	2,059	2,947	6,648
Omaha	5,251	907	2,044	2,300
New York	5,103	1,033	3,053	1,017
Kansas City, Kans.	4,952	1,046	1,571	2,335
South St. Paul	4,244	1,130	678	2,436
Sioux City	2,632	410	808	1,414
South St. Joseph	2,597	364	1,254	......
Milwaukee	2,104	691	......	1,340
East St. Louis	1,965	459	......	1,115
St. Louis	1,843	......	......	1,525
Fort Worth	......	536	......	......
Indianapolis	......	......	......	1,223
All stations	......	12,765	16,697	44,266
Argentina	......	2,679	4,730	380
Uruguay	......	1,394	2,979	......
Australia	......	1,947	15,911	......
New Zealand	......	367	10,643	......

15. STATISTICS OF RICE PRODUCTION AND TRADE

Country	Production (million pounds), 1930–31	Yield (pounds per acre), Average, 1929–31	Imports (million pounds), 1930	Exports (million pounds), 1930
India (including Burma)	72,124	865	....	5,862
Japan	21,009	2,463	397	....
Java and Madoera	8,053	886	1,385	.....
Indo-China	8,004	570	.....	2,451
Siam	6,620	901	.....	2,281
Chosen	6,026	1,232	.....	.....
Philippine Islands	3,064	705	24	1
Taiwan	2,315	1,484	.....	.....
Brazil	1,426	530	.....	.....
United States	1,248	2,097	54	259
Italy	885	2,579	13	468
Spain	425	3,434	.....	125
China	......	.....	2,652	.....
British Malaya	......	.....	2,106	490
Ceylon	......	701	1,063	.....
Germany	......	.....	550	.....
France	......	.....	534	.....
Cuba	......	.....	443	.....
Netherlands	......	.....	242	.....
United Kingdom	......	.....	254	.....
Argentina	......	.....	159	.....
Mauritius	......	.....	114	.....
Belgium	......	.....	105	.....

16. WHEAT-FLOUR PRODUCTION AT IMPORTANT MILLING CENTERS IN UNITED STATES
(Million barrels)

City	1929	1932
Buffalo	10.1	9.8
Minneapolis	10.8	7.3
Kansas City	8.0	7.1
Wichita	1.9	2.5
Toledo	2.3	2.3
Salina	2.0	1.9
Chicago	1.5	1.6
Tacoma	2.3	1.3
Portland	1.3	1.3
Seattle	1.5	1.2
St. Louis	2.0	1.1

14. PRODUCTION AND YIELD OF CORN
(Production in million bushels; yield in bushels per acre)

State or Country		1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
Connecticut	Production	3	4	3	3	2	3	2	2	2	2	2	2
	Yield	40.0	52.0	45.0	41.0	43.0	50.0	42.0	38.0	42.0	43.0	42.0	42.0
New York	Production	31	37	28	25	23	25	23	23	22	18	17	22
	Yield	40.0	46.0	35.5	32.4	34.0	36.0	35.0	34.0	34.0	31.1	30.0	39.0
Illinois	Production	314	306	313	337	295	395	322	254	367	304	230	340
	Yield	34.6	34.0	35.5	37.5	33.0	42.0	35.0	30.0	38.4	35.5	26.0	37.0
Kansas	Production	133	97	98	122	131	110	61	177	179	116	81	115
	Yield	26.5	22.2	19.3	21.7	21.7	16.6	11.0	30.0	27.0	15.5	12.0	17.5
Georgia	Production	66	70	53	49	46	42	55	55	38	41	36	37
	Yield	15.0	15.0	12.0	12.2	11.5	10.7	14.5	14.0	10.5	12.0	10.5	10.0
Argentina	Production	259	230	176	277	186	280	321	306	240	281	420	285
	Yield	31.6	28.5	22.4	32.7	20.3	26.3	30.3	28.5	26.6	26.9	36.2	29.9
Rumania	Production	182	111	120	151	155	164	239	139	109	251	178	239
	Yield	24.4	13.0	14.2	18.0	17.4	16.9	23.9	13.3	9.9	21.2	16.3	20.3

17. BUTTER AND OLIVE OIL
(Pounds per capita)

Country	Butter Production	Butter Import	Butter Export	Olive Oil Production
United States	17.7	0.02	0.026	0.013
United Kingdom	......	16.2	0.02	.....
Netherlands	23.19	0.55	11.66	.....
Denmark	119.3	0.39	105.2	.....
France	......	0.31	0.26	0.4
Italy	......	0.076	0.045	11.45
Germany	......	4.58	0.009	.....
Japan	0.07	0.009	......	.....
New Zealand	172.1	0.0006	140.13	.....

18. POTATO STATISTICS BY STATES

State	Production		Yield per Acre (bushels)
	Total (1,000,000 bushels)	Per Capita (bushels)	
Maine	49	60.8	266.6
New York	25	1.9	120.3
Minnesota	26	10.04	76.7
Colorado	14	13.4	149.3
Idaho	21	48	219.3
Virginia	14	5.09	128.7
Florida	3	2	109.3
Texas	4	0.7	76
United States (total)	346	2.89	110.8
Prince Edward Island	7	81.2	162.5

19. BUTTER PRODUCTION
(Pounds per capita)

Country	About 1900	1920	1931
United States	20.0	15.7	17.7
Argentina	3.77	7.4	6.9
New Zealand	38.5	54.8	172.1
Netherlands	24.2	19.39	23.19
Denmark (1914)	89.3	60.7	116.0

20. PER CAPITA CONSUMPTION
(Pounds)

Country	Coffee	Tea	Sugar
United States	12.03	0.73	120
France	8.87	0.08	...
Germany	4.70	0.20	...
Italy	2.52	.....	21
Sweden	15.42	.....	...
Belgium	10.38	.....	...
Netherlands	10.06	3.66	71
Norway	13.02	.....	...
United Kingdom	0.78	10.15	99
Canada	2.69	.....	...
Australia	.....	8.10	...
New Zealand	.....	8.30	...
Japan	.....	1.00	30

21. RAISIN PRODUCTION, IMPORTS, AND EXPORTS
(Million pounds)

Year	California Crop	Year	United States Exports	United States Imports
1880	1	1881	*	39
1900	94	1901	3	3
1920	277	1920	33	17
1931	...	1931	135	2

* None listed.

22. BANANA IMPORTS INTO THE UNITED KINGDOM AND THE UNITED STATES
(Thousand bunches)

Country	1927		1931	
	United Kingdom	United States	United Kingdom	United States
Canary Islands	1,809	......	892	......
British Honduras	......	459	......	170
Costa Rica	2,044	5,273	1,621	3,342
Guatemala	......	6,503	......	4,091
Honduras	2,645	16,323	2,700	21,228
Nicaragua	......	2,330	......	2,621
Panama	......	4,716	594	4,915
Mexico	......	5,721	......	5,164
Jamaica	1,971	15,105	6,971	10,315
Cuba	......	2,859	......	3,062
Colombia	3,771	1,630	1,675	890
Brazil	455	......	1,472	......
Others	1	90	237	56
Total	12,696	61,009	16,162	55,854

23. PRODUCTION OF FERTILIZER IN THE UNITED STATES
(Thousand tons)

State	1900	1929	1931
Alabama	139	531	313
Arkansas	.....	72	24
California	22	144	105
Connecticut	11	.....	45
Florida	26	546	434
Georgia	279	1,171	891
Illinois	104	322	221
Indiana	12	146	105
Louisiana	65	284	161
Maine	2	.....	89
Maryland	386	1,208	972
Massachusetts	84	175	163
Mississippi	38	155	101
Missouri	9	.....	.....
New Jersey	247	398	245
New York	164	123	139
North Carolina	140	978	768
Ohio	104	570	382
Pennsylvania	178	246	204
South Carolina	389	574	431
Tennessee	93	328	223
Texas	.....	119	54
Virginia	258	798	648
United States (total)	2,887	9,320	6,968

24. EXPORTS OF PALM NUTS AND PALM AND PALM-KERNEL OIL

(Metric tons)

Country	Average, 1909–13		1922		1925		1931	
	Nuts	Oil	Nuts	Oil	Nuts	Oil	Nuts	Oil
Nigeria	176,300	81,900	181,591	89,014	277,305	130,168	257,422	118,822
Sierra Leone	46,489	2,970	49,816	2,109	64,246	3,036	55,336	1,381
Belgian Congo	6,501	2,099	49,261	10,675	74,097	18,696	47,172	36,583
Dahomey	34,204	12,957	34,726	11,645	45,228	16,882	46,953	15,934
French Cameroon	15,514	3,608	23,007	2,210	36,423	6,275	33,231	5,869
Brazil	388	......	21,958	......	10,910	......	14,213	......
Netherland India	......	......	......	......	1,505	7,076	12,188	62,262
Portuguese Guinea	5,755	32	......	......	8,657	97	11,128	548
Total (25 countries)	374,900	224,700	401,700	161,275	595,900	276,200	530,300	312,800

25. COTTON AREA BY LEADING STATES AND YIELD PER ACRE

State	Thousands of Acres		Pounds, 1931–32
	1900	1931	
Alabama	3,404	3,271	171
Arkansas	1,743	3,506	214
Georgia	3,783	3,096	165
Louisiana	1,481	1,825	191
Mississippi	3,195	3,994	177
North Carolina	1,091	1,208	247
Oklahoma	255	3,376	172
South Carolina	2,195	1,759	213
Tennessee	663	1,053	225
Texas	7,179	14,754	159
United States (total)	25,758	38,705	181.7

26. UNITED STATES IMPORTS OF JUTE AND JUTE PRODUCTS

	Tons		Thousand Dollars	
	1928	1932	1928	1932
Jute, unmanufactured	59,506	27,976	8,773	1,804
Jute butts, unmanufactured	30,543	1,116	2,884	63
Jute burlap	276,780	152,921	80,087	16,908
Jute bagging	......	......	3,057	614
Jute bags or sacks	18,834	19,262	4,565	1,768
Other jute manufactures	10,793	28,617	1,911	1,312
Total	396,456	229,892	101,277	22,469

28. ESTIMATED ORIGINAL TONNAGE BY STATES

(Billions tons)

State	Lignite	Bituminous, Semi-bituminous, and Sub-bituminous	Anthracite and Semi-anthracite	Total Production from Earliest Record to End of 1930
Alabama	......	68.0	.....	0.6
Arkansas	0.09	1.4	0.4	0.1
Colorado	......	317.2	0.1	0.3
Georgia	......	0.9	.....	0.01
Illinois	......	201.4	.....	2.1
Indiana	......	53.0	.....	0.6
Iowa	......	29.2	.....	0.3
Kansas	......	30.0	.....	0.2
Kentucky	......	123.3	.....	0.9
Maryland	......	8.0	.....	0.2
Michigan	......	0.5	.....	0.04
Missouri	......	84.0	.....	0.2
Montana	315.5	65.6	.....	0.1
New Mexico	......	191.8	.....	0.1
North Carolina	......	0.2	.....	0.001
North Dakota	600.0	......	.....	0.02
Ohio	......	94.0	.....	1.2
Oklahoma	......	55.0	.....	0.1
Oregon	......	10.0	.....	0.002
Pennsylvania	......	112.1	21.0	9.1
Tennessee	......	25.7	.....	0.2
Texas	23.0	8.0	.....	0.05
Utah	......	93.3	.....	0.1
Virginia	......	21.1	0.9	0.3
Washington	......	63.9	0.02	0.1
West Virginia	......	152.5	.....	2.5
Wyoming	......	670.7	.....	0.2
Other states	1.0	1.9	.....	0.05
Total	939.6	2482.5	22.4	19.8

27. WORLD EXPORT OF TEA

(Millions of pounds)

Country	1900	1920	1931	Country	1900	1920	1931
India	192	288	343	Japan	43	26	25
Ceylon	149	185	244	Taiwan	20	15	17
Netherland India	17	102	127				
China	185	41	93	Total (including all others)	606	658	851

29. COAL PRODUCTION, RESERVES, AND TRADE

Country	Production (million tons)				Trade (million tons)		Reserve (billion tons)
	1900	1920	1931	Tons Per Capita, 1930	Imports	Exports	
United States	243	597	397	3.89	1	16	3,839
Germany....	150	252	252	4.40	7	34	423
United Kingdom..	229	233	222	5.28	..	55	190
France......	33	25	51	1.31	24	4	.....
Russia......	15	6	50	....	..	..	234
Poland......	...	7	38	1.25	..	12	.....
Japan.......	7	31	33	....	..	..	8
Czechoslovakia...	...	31	30	2.25	2	4	.....
Belgium.....	23	22	27	3.33	10	4	.....
China.......	...	19	25	....	..	..	996
India.......	6	17	24	....	..	..	79
Netherlands.	...	6	13	1.54	10	8	.....
Saar........	...	...	11	....	..	..	.....
Canada.....	5	15	11	....	..	..	1,234
Union of So. Africa.....	1	10	11	....	..	..	56
Spain.......	3	6	8	0.31	1	..	.....
Australia....	6	13	7	....	..	..	166
Austria-Hungary..	39	...	...	....	..	..	.....
Colombia....	...	...	...	....	..	..	27
Austria.....	...	...	...	0.48	5	..	54
Irish Free State.....	...	...	...	....	3	..	.....
Portugal....	...	...	...	0.04	1	..	.....
Greece......	...	...	...	....	1	..	.....
Denmark....	...	...	...	....	4	..	.....
Yugoslavia..	...	...	...	0.37	1	..	.....
Argentina...	...	...	...	....	3	..	.....
Turkey......	...	...	...	0.11	..	..	.....
AFRICA......	...	...	...	....	..	..	58
ASIA........	...	...	...	....	..	..	1,280
EUROPE.....	...	...	...	....	..	..	784
OCEANIA....	...	...	...	....	..	..	170
NORTH AMERICA..	...	...	...	....	..	..	5,073
SOUTH AMERICA..	...	...	...	....	..	..	32
WORLD......	...	...	...	....	..	..	7,398

30. COPPER PRODUCED
(Thousand tons)

State	1880	1900	1920	1929	1931
Alaska.............	..	...	33	20	12
Arizona............	1	59	276	415	200
California..........	1	14	6	17	4
Michigan...........	25	73	77	93	53
Montana...........	1	135	89	150	87
Nevada............	..	...	28	69	36
New Mexico.........	..	2	26	50	33
Utah..............	..	9	55	163	81
United States (total)	30	303	605	1026	525

31. PRODUCTION OF COAL BY LEADING STATES
(Million tons)

State	1910	1930	Total, End of 1930
Bituminous:			
Pennsylvania..............	151	124	5,234
West Virginia..............	62	121	2,535
Illinois....................	46	54	2,102
Kentucky..................	15	51	925
Ohio......................	34	23	1,191
Indiana...................	18	16	614
Alabama..................	16	16	557
Total bituminous..........	417	468	15,932
Anthracite:			
Pennsylvania..............	84	69	3,862
Grand total...............	502	537	19,793

32. WORLD PRODUCTION OF CRUDE PETROLEUM
(Millions of barrels of 42 United States gallons)

Country	1910	1920	1932
United States..................	210	443	782
U. S. S. R. (Russia)............	70	25	155
Venezuela......................	...	...	116
Rumania.......................	10	7	54
Persia.........................	...	12	49
Netherland India	11	18	39
Mexico........................	4	157	33
World total....................	328	689	1,306

33. WORLD PRODUCTION OF GOLD BY DECADES
(Million fine ounces)

Country		1851 to 1860	1871 to 1880	1891 to 1900	1901 to 1910	1921 to 1930
United States.	Quantity..	27	19	25	42	23
	Percentage	41	34	24	23	12
Australia.....	Quantity..	24	15	22	33	..
	Percentage	38	26	21	18	..
U. S. S. R. (Russia) ...	Quantity..	8	12	12	13	8
	Percentage	13	22	12	7	4
Colombia.....	Quantity..	1	1	..	..	..
	Percentage	2	3	..	..	..
Brazil........	Quantity..	1	..	..	..	..
	Percentage	1	..	..	..	..
New Zealand....	Quantity..	..	4	..	..	..
	Percentage	..	7	..	..	..
Canada......	Quantity..	..	..	4	7	16
	Percentage	..	..	4	4	9
Union of South Africa......	Quantity..	..	..	19	48	95
	Percentage	..	..	19	26	51
Mexico.......	Quantity..	..	..	..	..	7
	Percentage	..	..	..	..	4
World......	Quantity..	65	57	102	184	186
	Percentage	..	..	..	..	..

34. PRODUCTION OF COPPER BY COUNTRIES
(Thousand tons)

Country	1881	1900	1929	1931
United States	36	303	1,026	525
Belgian Congo	...	...	151	169
Chile	43	29	349	248
Canada	1	9	121	146
Japan	4	31	83	84
Mexico	...	25	87	58
U. S. S. R. (Russia)	...	...	41	53
Peru	1	9	60	49
Spain and Portugal	43	59	54	37
Germany	14	23	32	31
World total	181	545	2,128	1,501

35. GOLD PRODUCTION IN LEADING STATES
(Thousand fine ounces)

State	1880	1900	1920	1930
California	847	765	716	457
Nevada	232	97	175	149
South Dakota	174	299	210	407
Colorado	155	1,395	363	219
Montana	116	227	92	43
Alaska	....	395	413	410
Arizona	19	203	240	169
Utah	10	192	103	208
United States (total)	1,742	3,830	2,414	2,318

36. GOLD AND SILVER PRODUCTION BY COUNTRIES, 1493–1930
(Million fine ounces)

Country	Gold	Silver
Union of South Africa	251	....
United States	220	3,166
Australia	148	486
U. S. S. R. (Russia)	93	....
Colombia	48	93
Brazil	38	....
Canada	38	611
Mexico	34	5,446
New Zealand	22	....
Bolivia	10	1,585
Peru	7	1,408
Germany	....	513
Austria	....	325
Chile	....	297
Japan	....	250
World (total)	1,063	15,124

38. SILVER PRODUCTION BY COUNTRIES
(Million fine ounces)

Country	1900	1928	1931
United States	58	58	32
Mexico	57	109	86
Australia	13	...	10
Bolivia	11	...	...
Peru	7	22	9
Canada	...	22	21
India	...	7	...
World	174	258	196

39. PRODUCTION OF ALUMINUM BY COUNTRIES
(Thousand metric tons)

Country	1912	1925	1930
United States	20	64	104
Canada	8	14	35
France	13	18	29
Switzerland	} 12	21	21
Germany		27	30
Austria-Hungary			
United Kingdom	8	10	14
Norway	2	21	27
Austria	...	3	4
Italy	...	2	8
World (total)	63	180	272

40. PRODUCTION OF LEAD
(Tons)

State	1901	1928	1931
Missouri	......	195,393	160,121
Idaho	79,654	145,323	99,365
Utah	49,870	145,915	79,212
Colorado	73,265	26,751	6,884
United States (total)	284,797	627,153	404,622

41. PRODUCTION OF ZINC
(Tons)

State	1900	1928	1931
New Jersey	......	99,871	94,285
Oklahoma	......	180,252	78,132
Kansas	62,136	107,251	39,051
United States (total)	123,886	695,170	410,318

37. SULPHUR PRODUCTION BY COUNTRIES
(Thousand tons)

Country	1900	1931
United States	3	2,129
Italy	535	348
Japan	14	60
Chiie	2	14
Spain	1	10
World (total)	555	2,561

42. OCCUPATIONS IN UNITED STATES

	1840	1890	1930
Percentage of persons 10 years of age and over gainfully employed in:			
Agriculture	77.5	39.7*	21.4
Manufacture and mechanical industries	16.5	22.4	28.9
Trade, transportation, and communication	4.3	14.6	20.4

* Includes fishing and mining.

43. IMPORTANCE OF TEXTILES TO UNITED KINGDOM

	1856	1900	1930
Percentage which textiles form of total exports	36.4	24.5	17.1
Value of textile exports (million pounds sterling)	42	71	98
Value of total exports (million pounds sterling)	116	291	571

44. CACAO EXPORTS BY COUNTRIES

(Metric tons)

Country	1890	1910	1931
Gold Coast	13	22,989	241,336
Nigeria	21	2,978	50,047
Sao Tomé	7,023	36,148	12,000
Ivory Coast	0	8	20,000
Cameroons	120	3,431	12,500
Fernando Po	500	2,445	10,000
Brazil	10,846	29,158	70,000
Ecuador	18,956	36,305	15,000
Trinidad	13,550	26,240	29,717
Venezuela	7,712	17,360	20,000
Dominican Republic	1,660	16,623	26,000
World	76,933	218,499	543,000

45. WORLD PRODUCTION OF SUGAR

(Thousand tons)

	1870	1890	1910	1920	1930
Cane	1,585	2,069	9,870	14,225	19,116
Beet	831	3,633	8,964	5,321	12,742
Total imports into United States	639	1,742	2,789	4,305	5,020

46. EXPORTS OF COCONUTS

(Metric tons)

Jamaica	35,716
Portuguese India	31,334
Ceylon	34,002
Philippine Islands	16,822
Panama	7,446
Trinidad and Tobago	5,886

47. SOME SUGAR STATISTICS

(Production in terms of raw sugar; exports, both raw and refined)

(Thousand short tons)

Country	Production		Exports	
	1930–31	1932–33	1930	1932
India	3,604	5,209	48	0.4
Cuba	3,495	2,234	3,598	2,890
Netherland India	3,245	1,497	2,469	1,668
Germany	2,808	1,193	328	90
U. S. S. R. (Russia)	1,914	1,102	112	84
France	1,324	1,088	309	312
United States: Cane	(184)	(223)		
Beet	(1,298)	(1,406)		
Total	1,482	1,629	78	49
Czechoslovakia	1,260	695	572	435
Brazil	1,033	1,080	93	45
Hawaii	989	1,009	866	1,471
Philippines	958	1,180	820	1,121
Poland	863	460	435	204
World	31,858	26,777	11,698	9,211

48. EXPORTS OF RUBBER

(Thousand tons)

Middle Eastern Plantation:	
British Malaya	445
Netherland India	275
Ceylon	63
British Borneo	18
French Indo-China	16
Siam	7
India, including Burma	4
Total Middle Eastern Plantation	828
American:	
Amazon	10
Total American	10
Africa	2
World Total	840

49. RUBBER IMPORTS BY COUNTRIES

(Thousand tons)

Country	1931	1933
United States	476	398
United Kingdom	85	73
Japan	43	62
France	46	60
Germany	40	53
U. S. S. R. (Russia)	27	27
Italy	10	21
Canada	25	19
Australia	8	15
Belgium	11	11

50. WORLD PRODUCTION OF RUBBER
(Tons)

Year	Plantations	Wild		Total
		Amazon	Rest	
1900	4	26,750	27,136	53,890
1905	145	35,000	27,000	62,145
1910	10,916	37,938	45,096	93,950
1915	116,370	34,610	19,846	170,826
1920	305,106	23,216	13,711	342,033
1925	488,825	25,298	14,362	528,485
1930	797,731	14,260	5,740	817,731
1933	828,000	10,000	2,000	840,000

51. VALUE OF TEXTILE MANUFACTURE AND TRADE
(Millions of dollars)

Country	Production	Imports	Exports
United States	4,910	98	104
Canada	362	112	....
Mexico	91	18	....
United Kingdom	3,860	148	476
Germany	....	58	216
Belgium	....	42	3
France	....	41	258
Czechoslovakia	....	14	100
Switzerland	....	26	58
Italy	....	32	120

52. AUTOMOBILE PRODUCTION IN UNITED STATES

State	Establishments	Products (millions of dollars)
Michigan	40	1,550
Ohio	35	387
Missouri	8	247
New York	18	232
Wisconsin	15	219
Indiana	15	208
California	23	138
New Jersey	6	132
Pennsylvania	14	100
Illinois	19	62
United States (total)	244	3,723

53. CRUDE RUBBER IMPORTS BY COUNTRIES
(Thousand tons)

Country	Average 1910–14	1931
United States	51	502
United Kingdom	20	85
Germany	15	40
France	5	46
Canada	2	25
Japan	1	43
Italy	3	10

54. EXPORTS OF COPRA
(Metric tons)

Netherland India	360,171
British Malaya	190,850
Philippine Islands	174,239
Ceylon	95,372
New Guinea	63,303
Fiji Islands	24,265
Mozambique	21,941
Solomon Islands	21,549

55. EXPORTS OF COCONUT OIL
(Metric tons)

Philippine Islands	164,970
Ceylon	48,911
Netherlands	39,725
Denmark	19,676
British Malaya	10,341
France	9,020
Germany	8,979
Netherland India	4,858

56. LEADING EXPORTS OF THE UNITED STATES
(Millions of dollars)

Commodity	1928	1933
Cotton, unmanufactured	920.0	398.2
Petroleum and products	525.9	200.0
Machinery	492.7	132.5
Automobiles, parts and accessories	501.6	90.6
Passenger cars and trucks	354.9	52.2
Tobacco, unmanufactured	154.5	82.9
Chemicals and related products	137.3	76.8
Fruits and nuts	129.3	69.7
Dried and evaporated fruit	39.6	21.8
Canned fruit	26.8	17.1
Fresh apples	26.7	13.1
Packing-house products	186.6	65.8
Iron and steel mill products	179.6	45.5
Coal and coke	99.5	40.4
Cotton manufactures, including yarns	134.6	39.4
Cloth, duck, tire fabric	79.3	23.5
Sawmill products	108.8	32.3
Boards and timber	108.0	32.2
Copper, including ore and manufactures	169.8	24.9
Iron and steel advanced manufactures	85.0	20.0
Wheat, including flour	193.7	18.6
Wheat, grain	119.9	4.8
Rubber and manufactures	69.5	17.8
Automobile casings	31.1	9.0
Furs and manufactures	39.5	15.3
Naval stores, gums, and resins	26.4	14.7
Paper and manufactures	30.8	14.6
Leather	55.2	13.8
Photographic and projection goods	21.5	12.5
Wood manufactures, advanced	37.5	11.6
Books and printed matter	24.2	11.4
Sulphur, crude	14.3	9.9
Oil cake and meal	27.2	8.6
Vegetables and preparations	22.7	7.5
Fish	20.8	7.4
Tobacco manufactures	24.7	6.7
Soap and toilet preparations	15.7	5.4
Silk manufactures	18.6	4.9
Dairy products	18.5	4.0
All others	544.1	144.5
Total Exports of United States	5,030.1	1,647.2

57. SOME IMPORTANT STATISTICS CONCERNING THE OCCUPATIONS OF PEOPLES IN OF THE

Country	Distribution of Persons in Gainful Occupations. Given in Percentage of Total Employed. Latest Available Data				Bushels of Grain Produced per Capita, 1931	Yield of Wheat, Bushels per Acre, Latest 3-Year Average Available	Cattle per Capita, 1932, or Latest Available	Hogs, Sheep, and Goats per Capita, 1931, or Latest Available	Tons (metric) of Coal and Lignite Mined per Capita, 1932	Developed Water Power in Thousands of Horse Power, 1931	Available Water Power in Thousands of Horse Power, 1931
	Agriculture, Forestry, and Fisheries	Manufacturing and Mechanical Industries	Extraction of Minerals	Trade and Transportation							
EUROPE:											
Austria	31.9	33.3		12.2	10	25.3	0.3	0.4	0.5	700	1,660
Belgium	19.1	39.9	6.6	18.3	11	37.8	0.2	0.2	2.6	....	....
Bulgaria	81.0	8.9	0.3	5.4	23	18.9	0.4	1.8	0.2	50	1,200
Czechoslovakia	40.3	34.1	2.7	10.0	16	26.1	0.3	0.3	2.0	155	1,000
Denmark	34.8	27.0	....	16.7	36	42.5	0.9	1.6	....	11	20
Estonia	....	....	....	....	22	16.3	0.6	0.7	....	19	125
Finland	63.4	14.4	....	7.4	18	24.5	0.5	0.4	....	250	1,800
France	38.3	31.2	2.0	11.4	17	23.6	0.4	0.4	1.1	2,300	5,400
Germany	30.5	38.1	3.2	16.4	15	32.5	0.3	0.5	3.5	2,000	2,000
G. Britain and N. Ireland	6.8	39.7	7.5	20.9	5	32.8	0.2	0.7	4.6	400	850
Greece	....	....	....	....	5	12.6	0.1	1.9	....	8	250
Hungary	58.2	18.6	1.1	8.2	22	19.3	0.2	0.5	0.5	3	175
Irish Free State	....	....	....	....	14	39.1	1.4	1.7	....	......	......
Italy	56.1	24.0	0.6	18.4	10	22.3	0.2	0.4	....	4,840	3,800
Latvia	....	....	....	....	22	19.5	0.6	0.9	....	......	......
Lithuania	....	....	....	....	26	17.8	0.5	1.1	....	......	......
Netherlands	23.6	36.1	1.7	21.3	5	41.1	0.3	0.3	1.6	1	17
Norway	35.3	26.5		21.8	5	24.9	0.5	0.8	....	1,900	9,500
Poland	75.9	8.7	0.7	5.6	17	15.5	0.3	0.3	0.9	90	1,400
Portugal	57.5	21.5	0.4	9.1	7	11.6	0.1	1.0	0.03	48	300
Rumania	79.5	7.8	0.2	4.5	28	13.0	0.3	0.9	0.1	109	1,600
Spain	....	....	....	....	14	13.4	0.2	1.3	0.3	1,000	4,000
Sweden	40.7	30.2	0.8	14.3	22	31.8	0.5	0.4	0.06	1,675	5,000
Switzerland	25.9	44.1	0.3	16.6	2	31.2	0.4	0.3	0.001	2,300	2,500
Turkey (Europe and Asia)	....	....	....	....	17	10.9	0.4	1.6	0.08	......	......
U.S.S.R. (Europe and Asia)	86.7	6.1		3.0	22	9.9	0.3	0.7	0.3	446	16,425
Yugoslavia	....	....	....	....	19	16.1	0.3	1.0	0.4	212	3,000
OTHER COUNTRIES:											
Argentina	16.8	26.6	....	12.8	51	13.3	2.8	4.6	....	35	5,000
Australia	22.9	31.2	2.9	24.3	26	12.8	1.9	17.1	1.0	2	6,000
Canada	35.0	26.9	1.6	20.8	78	13.0	0.8	0.8	1.1	6,125	18,000
Egypt	69.2	8.4	....	7.4	10	28.5	0.1	0.1	....	......	600
India	72.3	11.2	0.3	7.3	8	10.5	0.6	0.3	0.05	300	27,000
Japan	....	....	....	....	9	25.3	0.02	0.01	0.4	3,500	6,000
Mexico	....	....	....	....	6	9.8	0.2	0.6	0.06	494	6,000
United States	21.9	28.9	2.0	20.4	39	13.5	0.5	0.9	2.6	14,885	38,000

58. CUT, CONSUMPTION, AND STAND OF LUMBER IN THE UNITED STATES

(Millions of feet, board measure)

Groups of States	Cut, Aggregate of Ten Years, 1920–29, Inclusive			Consumption, One Year, 1928			Stand of Saw-timber, 1930		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Northeastern States	15,642	9,470	6,172	8,306	6,949	1,357	82,644	40,815	41,829
Southern States	187,264	139,427	47,837	8,977	6,735	2,242	220,997	124,219	96,778
North Central States	29,833	12,389	17,444	11,083	8,183	2,900	53,398	12,772	40,626
Western States	138,632	138,462	170	7,015	6,914	101	1,310,764	1,308,044	2,720
Total United States	371,371	299,748	71,623	35,381	28,781	6,600	1,667,803	1,485,850	181,953

PRINCIPAL EUROPEAN COUNTRIES AND COUNTRIES REPRESENTATIVE OF OTHER PARTS WORLD

Value of Manufactures per Capita (dollars), Latest Available Data	Number of Persons per Cotton Spindle, 1932	Number of Persons per Telephone Instrument, 1930	Number of Persons per Automobile, 1933	Railway Mileage, 1930	Freight, Ton Miles per Capita, 1930	Merchant Marine (thousands of gross tons), 1933–34	Imports from United States (thousand dollars), 1932 (Foreign Countries' Figures)	Exports to United States (thousand dollars), 1932 (Foreign Countries' Figures)	Number of Persons in All Schools per 100 Population, Latest Available Years	Country
										EUROPE
....	8.8	29	195	4,157	351	....	7,908	2,119	13	Austria
....	3.8	26	45	2,997	461	456	39,543	19,878	15	Belgium
....	....	333	2,009	1,825	92	....	464	192	14	Bulgaria
....	4.1	105	150	6,880	....	....	31,872	14,978	14	Czechoslovakia
....	....	10	30	3,291	....	1,168	16,479	1,071	15	Denmark
....	....	70	365	1,180	153	126	992	413	11	Estonia
41	....	29	120	3,196	270	421	4,166	6,882	11	Finland
108	4.1	36	23	39,725	707	3,512	114,403	37,530	12	France
....	6.3	20	105	33,466	495	3,901	140,968	66,982	16	Germany
333	0.9	23	28	20,403	393	18,701	293,772	53,318	17	G. Britain and N. Ireland
11	....	435	413	1,557	12	1,417	9,041	4,028	12	Greece
41	....	81	543	5,390	....	....	2,471	465	14	Hungary
40	....	96	60	3,027	....	....	4,629	362	18	Irish Free State
....	7.8	109	129	13,653	186	3,150	57,006	32,717	12	Italy
45	....	39	593	1,712	131	198	611	166	12	Latvia
8	....	163	1,022	1,056	80	....	635	104	11	Lithuania
52	....	24	61	2,285	....	2,765	34,459	11,761	16	Netherlands
....	....	15	54	2,407	121	4,080	16,548	8,341	15	Norway
....	18.9	156	1,273	12,179	396	67	11,663	1,126	13	Poland
....	....	181	134	2,128	....	266	8,526	1,595	6	Portugal
11	....	322	610	6,917	117	93	3,481	204	12	Rumania
....	11.0	107	149	9,671	....	1,232	31,095	10,089	12	Spain
178	....	12	42	10,445	430	1,675	44,977	33,573	13	Sweden
....	3.1	14	44	3,354	337	....	22,183	10,628	14	Switzerland
....	....	641	3,133	3,305	....	188	1,072	5,719	3	Turkey (Europe and Asia)
....	18.0	426	2,915	50,269	577	843	16,307	8,762	12	U.S.S.R. (Europe and Asia)
....	....	196	1,211	6,296	108	374	2,076	476	10	Yugoslavia
										OTHER COUNTRIES
....	....	38	38	24,805	....	342	32,532	25,853	12	Argentina
133	....	12	12	27,477	558	642	27,378	5,960	20	Australia
260	8.4	7	9	42,075	2,703	1,416	232,262	149,698	25	Canada
....	....	338	485	2,072	....	48	3,137	4,793	4	Egypt
....	37.9	6,082	2,908	42,281	59	200	27,502	26,741	4	India
38	8.5	80	650	13,420	111	4,258	143,326	125,131	16	Japan
26	19.9	180	191	14,439	115	42	36,768	63,405	10	Mexico
331	3.9	6	5	260,440	3,142	13,358	......	......	24	United States

59. MERCHANT MARINE OF THE WORLD AND PRINCIPAL COUNTRIES

Country	Thousands of Gross Tons	Gross Tons per Capita
United Kingdom	18,701	0.44
United States	13,358	0.11
Japan	4,258	0.07
Germany	3,901	0.07
France	3,512	0.09
Italy	3,150	0.08
Netherlands	2,765	0.39
British Dominions	3,077	....
Sweden	1,675	0.28
Norway	4,080	1.44
All other	8,787	....

60. ESTIMATED PRODUCTION OF MEAT BY COUNTRIES

(Million pounds)

United States	16,803
Germany	6,311
Argentina	4,258
France	3,517
United Kingdom	2,960

61. ESTIMATED CONSUMPTION OF MEAT AND LARD BY COUNTRIES

(Million pounds)

United States	18,363
Germany	7,454
Argentina	3,399
France	3,607
United Kingdom	5,715

62. COUNTRIES OF THE WORLD. Area in square miles, total population, population per square mile, value of trade with the United States, and value of total imports and exports.

Country	Year	Area, Square Miles	Total Population (thousands)	Population per Square Mile	Millions of Dollars		
					1928 Trade with United States	1932 Trade with United States	Total Imports and Exports
NORTH AMERICA	......	....	177,500	....	......	......	......
Alaska	1930	586,400	59	0.1	104.4	49.8	50.3
Bermuda	1932	19	28	1,526.3	4.9	3.2	7.1
Canada (land area)	1931	3,542,049	10,374	2.9	1,312.0	380.0	840.8
Alberta	1931	250,925	732	2.9	......	......	......
British Columbia	1931	353,416	694	2.0	......	......	......
Manitoba	1931	231,926	700	3.0	......	......	......
New Brunswick	1931	27,911	408	14.6	......	......	......
Northwest Territories	1931	1,258,217	7	0.006	......	......	......
Nova Scotia	1931	21,068	513	23.7	......	......	......
Ontario	1931	365,880	3,432	9.4	......	......	......
Prince Edward Island	1931	2,184	88	40.3	......	......	......
Quebec	1931	583,895	2,874	4.9	......	......	......
Saskatchewan	1931	240,000	922	3.8	......	......	......
Yukon Territory	1931	206,427	4	0.02	......	......	......
Central America	......	212,012	13,118	....	......	......	......
British Honduras	1931	8,598	651	5.9	5.7	1.5	6.8
Costa Rica	1932	23,000	6,540	23.0	13.3	7.8	14.1
Guatemala	1932	42,364	2,195	52.4	24.5	7.0	18.2
Honduras	1930	46,250	860	18.6	21.9	18.3	26.0
Nicaragua	1930	49,500	925	18.7	11.8	5.1	8.0
Panama	1930	28,575	467	16.3	13.0	7.3	10.9
Panama Canal Zone	1931	549	42	71.9	......	......	......
Salvador	1930	13,176	1,438	109.1	15.0	5.3	10.5
Greenland	1931	46,740	17	....	0.4	......	2.1
Mexico	1930	760,290	16,525	21.7	367.0	100.2	154.6
Newfoundland	1931	42,734	277	6.5	} 17.5	13.8	40.5
Labrador	1931	110,000	4	0.4			
United States (land area)	1932	2,973,776	124,822	42.0	......	......	2,933.8
West Indies	......	95,800	12,045	....	......	......	......
Bahama Islands	1932	4,404	61	13.8	......	......	4.2
Cuba	1931	44,164	3,962	89.7	414.0	85.1	131.7
Dominican Republic	1932	19,332	1,275	64.7	28.4	7.5	19.0
Haiti	1929	10,204	2,550	249.9	13.5	5.8	14.7
Jamaica	1932	4,450	1,051	236.1	18.3	6.0	27.0
Puerto Rico	1931	3,435	1,574	458.2	186.3	123.1	132.5
Virgin Islands	1930	133	22	165.4	3.5	1.3	2.5
British West Indies (including Jamaica)	1931	12,611	2,023	160.4	141.5	14.7	86.4
French West Indies	1931	1,068	506	475.6	......	2.4	29.0
Netherland West Indies	1931	403	72	188.6	......	30.7	129.8
SOUTH AMERICA	......	....	85,000	....	......	......	......
Argentina	1931	1,079,965	11,659	10.8	260.7	58.4	546.1
Bolivia	1931	514,600	3,052	5.9	10.9	3.9	15.1
Brazil	1931	3,286,170	41,478	12.6	310.5	116.1	288.7
Chile	1932	286,396	4,402	15.2	107.7	11.7	44.6
Colombia	1932	444,100	8,828	18.9	146.6	63.9	96.1
Ecuador	1931	110,000	2,500	22.7	9.1	5.5	14.9
Falkland Islands	1931	5,618	3	0.5	......	......	......
Guiana, British	1931	89,480	311	3.5	2.5	0.9	12.4
Guiana, French	1931	34,749	29	1.4	0.2	0.1	2.6
Paraguay	1930	176,000	852	4.8	2.3	0.5	11.3
Peru	1930	524,800	6,237	11.9	65.1	11.4	58.0
Surinam (Netherland Guiana)	1931	54,305	155	2.9	2.6	1.3	4.0
Uruguay	1931	72,172	1,938	26.8	33.3	3.7	52.4
Venezuela	1932	393,976	3,262	8.2	63.3	30.7	118.0
EUROPE	......	....	535,000	....	......	......	......
Albania	1930	10,629	1,003	94.4	......	0.2	7.1
Andorra	......	191	5	26.2	......	......	......
Austria	1931	32,377	6,733	207.6	29.3	10.0	302.3
Belgium	1931	11,754	8,159	688.4	146.7	59.4	864.0

62. COUNTRIES OF THE WORLD—(Continued)

Country	Year	Area, Square Miles	Total Population (thousands)	Population per Square Mile	Millions of Dollars		
					1928 Trade with United States	1932 Trade with United States	Total Imports and Exports
EUROPE—*Continued*							
Bulgaria	1932	39,825	6,128	151.4	1.2	0.7	49.3
Czechoslovakia	1932	54,196	14,915	273.9	66.3	46.9	438.0
Danzig	1929	754	408	541.1	......	......	......
Denmark (excluding Faeröerne)	1932	16,576	3,590	215.1	69.0	17.6	428.1
Faeröerne (Faeröe Islands)	1930	540	24	44.4	......	......	......
Estonia	1933	18,358	1,124	61.0	4.0	1.4	21.3
Finland	1931	132,578	3,667	27.6	33.2	11.0	126.1
France (total)	1931	212,736	41,835	196.7	580.7	151.9	1,941.2
Corsica	1931	3,367	297	88.2	......	......	......
Germany	1932	180,986	64,776	357.9	676.9	208.0	2,478.7
Gibraltar (British)	1931	2	21	10,686.0	......	......	......
Great Britain and Northern Ireland	1931	94,281	46,189	489.9	1,195.0	347.1	3,924.0
England	1931	50,327	37,355	742.2	......	......	......
Scotland	1931	30,405	4,843	159.5	......	......	......
Wales	1931	8,016	2,593	323.5	......	......	......
Northern Ireland	1931	5,237	1,257	240.0	......	......	......
Channel Islands	1931	75	93	1,240.8	......	......	......
Isle of Man	1931	221	49	223.2	......	......	......
Greece (total)	1932	50,270	6,483	127.3	36.5	13.1	65.0
Crete	1928	3,195	386	121.1	......	......	......
Hungary	1932	35,875	8,781	243.5	4.9	2.9	116.4
Iceland	1930	39,709	109	2.7	0.3	0.4	12.3
Irish Free State	1932	26,601	2,974	111.2	24.8	5.0	243.7
Italy (total)	1932	119,744	41,814	344.3	289.1	89.7	773.0
Sardinia	1931	9,299	973	104.6	......	......	......
Sicily	1931	9,935	3,897	392.2	......	......	......
Latvia	1932	25,402	1,920	75.5	2.4	0.8	34.9
Liechtenstein	1930	65	10	157.1	......	......	......
Lithuania	1933	21,490	2,422	111.4	1.9	0.7	35.6
Luxembourg	1931	999	300	301.3	......	......	......
Malta (British)	1931	122	242	1,980.5	......	......	12.9
Monaco	1928	8	25	3,125.0	......	......	......
Netherlands	1933	13,214	8,183	607.7	133.8	46.2	862.5
Norway	1932	119,148	2,831	23.6	56.1	24.9	228.6
Poland	1932	149,957	32,176	214.2	43.9	12.8	218.3
Portugal (total)	1931	35,880	6,717	187.2	15.2	10.1	81.5
Azores	1930	924	254	275.0	......	......	......
Madeira Islands	1930	314	210	675.8	......	......	......
Rumania	1931	113,887	18,166	158.3	......	3.7	170.8
San Marino	1932	38	14	368.4	......	......	......
Spain (total)	1932	194,237	23,656	121.8	118.3	41.2	330.6
Balearic Isles	1932	1,908	368	192.8	......	......	......
Canary Islands	1932	2,807	565	201.3	......	......	......
Sweden	1932	158,510	6,190	38.7	100.6	78.6	388.3
Switzerland	1932	15,944	4,120	256.2	82.8	32.8	478.1
Turkey in Europe (see Asia)	1930	9,257	1,072	115.8	......	......	......
U. S. S. R. (Soviet Union) (see Asia)	1933	8,244,228	165,700	19.7	86.9	25.1	650.2
Russia S. F. S. R. (Europe and Asia)	1931	7,628,546	110,933	14.5	......	......	......
Transcaucasian S. F. S. R.	1931	71,232	6,427	90.2	......	......	......
White Russia S. S. R.	1931	48,954	5,246	107.2	......	......	......
Ukraine S. S. R.	1931	174,413	31,403	180.0	......	......	......
Yugoslavia	1931	96,010	13,931	145.0	5.3	2.6	97.0
ASIA	......	....	1,100,000	....	......	......	......
Afghanistan (estimated)	......	250,000	11,000	27.9	......	......	......
Arabia (estimated)	......	1,000,000	7,000	7.0	......	......	......
Aden Protectorate (British)	......	9,000	100	11.1	3.5	0.6	26.3
Oman	......	82,000	500	6.1	......	......	......
Saudi	......	....	4,000	....	......	......	......
Yemen	......	75,000	2,300	30.7	......	......	......
Bhutan	......	18,000	300	16.7	......	......	......
Ceylon	1931	25,332	5,313	209.7	51.6	11.5	101.5

62. COUNTRIES OF THE WORLD—(Continued)

Country	Year	Area, Square Miles	Total Population (thousands)	Population per Square Mile	Millions of Dollars		
					1928 Trade with United States	1932 Trade with United States	Total Imports and Exports
ASIA—*Continued*							
Chinese Republic	1932	4,300,000	474,787	110.4	199.1	111.9	533.5
China Proper	1930	1,555,000	462,387	297.4	......	......	......
Manchuria (Manchoukuo)	1930	364,000	26,623	73.1	......	......	......
Mongolia	1930	1,368,000	6,160	4.5	......	......	......
Sinkiang (Chinese Turkestan)	1930	550,000	2,552	4.6	......	......	......
Tibet	1930	463,000	3,722	8.0	......	......	......
Cyprus	1931	3,584	348	97.1	......	......	7.9
French Indo-China	1931	284,900	21,600	75.8	1.6	1.4	77.9
India and Dependencies	1931	1,819,000	352,987	194.1	188.2	54.2	716.3
British India	1931	1,107,968	271,749	245.3	......	......	......
Baluchistan	1931	134,638	869	6.4	......	......	......
Burma	1931	233,492	14,667	62.4	......	......	......
Native States	1931	711,032	81,238	114.3	......	......	......
Iraq	1931	143,250	3,250	22.7	......	3.0	30.9
Japanese Empire	1930	260,514	90,395	347.0	714.7	272.9	989.1
Japan Proper	1933	147,462	66,297	449.6	......	268.5	798.7
Chosen (Korea)	1930	85,228	21,058	247.1	......	1.5	177.6
Karafuto (Sakhalin)	1930	13,934	295	21.2	......	......	......
Taiwan (Formosa)	1930	13,840	4,715	331.9	......	2.9	12.8
Malaya, British	1931	52,603	4,354	86.1	......	32.2	285.0
Federated Malay States	1931	27,430	1,713	62.4	......	......	......
Non-federated Malay States	1931	22,040	1,527	69.3	......	......	......
Straits Settlements	1931	1,535	1,114	725.7	......	......	......
British North Borneo	1931	31,106	270	8.7	......	......	......
Brunei	1931	2,500	39	15.6	......	......	......
Sarawak	1931	50,000	600	12.0	......	......	......
Nepal	......	54,000	5,600	103.7	......	......	......
Netherland India	1930	733,494	60,731	82.8	122.3	36.3	366.8
Borneo	1930	206,115	2,195	10.6	......	......	......
Celebes	1930	73,180	4,227	57.8	......	......	......
Java and Madoera (Madura)	1930	51,219	41,720	814.5	......	......	......
New Guinea and Molucca Islands	1930	192,453	893	4.6	......	......	......
Sumatra	1930	163,138	7,661	47.0	......	......	......
Other Islands	1930	47,389	4,035	85.1	......	......	......
Palestine (British Mandate)	1931	8,880	1,035	116.6	1.3	1.8	36.4
Persia	1930	628,000	10,000	15.9	9.5	3.8	89.0
Philippine Islands (U. S.)	1931	114,400	12,419	108.6	193.7	125.8	174.7
Siam	1931	200,234	11,940	58.4	2.9	1.6	75.6
Syria and Lebanon (French Mandate)	1931	77,220	2,768	35.8	6.5	2.3	44.8
Transjordania	1931	15,444	270	17.5	......	......	......
Turkey (Europe and Asia)	1930	294,492	14,100	47.9	17.1	6.8	88.6
Turkey in Asia (see Europe)	1930	285,235	13,028	42.9	......	......	......
U. S. S. R. (Soviet Union) (see Europe)							
Tadzhik S. S. R.	1931	54,826	1,174	21.4	......	......	......
Turcoman S. S. R.	1931	189,658	1,138	6.0	......	......	......
Uzbek S. S. R.	1931	75,598	4,685	62.0	......	......	......
AUSTRALIA, NEW ZEALAND, AND LARGER ISLANDS OF THE PACIFIC	......	....	10,000	....	......	......	......
Australia	1931	2,974,581	6,526	2.2	262.0	33.3	455.8
Federal Territory	1931	940	9	2.7	......	......	......
New South Wales	1931	309,432	2,518	6.8	......	......	......
Northern Territory	1931	523,620	4	0.01	......	......	......
Queensland	1931	670,500	964	1.1	......	......	......
South Australia	1931	380,070	585	1.3	......	......	......
Tasmania	1931	26,215	223	8.2	......	......	......
Victoria	1931	87,884	1,801	17.4	......	......	......
Western Australia	1931	975,920	422	0.3	......	......	......
Fiji Islands (British)	1932	7,435	186	24.9	......	......	8.4
Guam (U. S.)	1930	206	19	92.2	0.3	0.2	0.5
Hawaiian Islands (U. S.)	1931	6,407	382	59.6	192.1	141.2	147.1

62. COUNTRIES OF THE WORLD—(Continued)

Country	Year	Area, Square Miles	Total Population (thousands)	Population per Square Mile	Millions of Dollars: 1928 Trade with United States	1932 Trade with United States	Total Imports and Exports
AUSTRALIA, NEW ZEALAND—*Continued*							
New Caledonia (French)	1931	7,202	57	7.6	......	......	......
New Guinea, Territory of (Australian Mandate)	1931	93,460	390	4.2	......	......	......
Bismark Archipelago	1931	19,660	143	7.2	......	......	......
German Solomon Islands	1931	4,100	40	9.8	......	......	......
North Eastern New Guinea	1931	69,700	207	3.0	......	......	......
New Hebrides (British)	1931	4,633	63	13.6	......	......	......
New Zealand	1932	103,415	1,455	14.7	52.3	12.8	189.8
Papua, Territory of (Australian Mandate)	1930	90,540	276	3.1	......	......	......
Samoa, Western (New Zealand Mandate)	1932	1,260	46	36.5	......	......	......
Samoan Islands (U. S.)	1930	76	10	132.3	......	......	......
Solomon Islands (British Protectorate)	1931	14,600	94	6.4	......	......	......
Tonga (Friendly Island) (British)	1931	390	29	74.4	......	......	......
AFRICA	......	....	150,000	....	......	......	......
Independent Countries:							
Egypt	1932	386,000	14,945	....	45.2	7.9	191.4
Egypt (excluding desert)	1932	13,600	14,945	1,098.9	......	......	......
Ethiopia (estimated)	1930	347,490	10,000	28.8	......	0.3	......
Liberia (estimated)	1930	46,332	2,500	54.0	1.1	0.1	1.5
International (British, French, Italian, Spanish):							
Tangier Zone of Morocco	1931	225	51	226.7	......	......	......
Belgian Sphere of Influence:							
Belgian Congo	1931	920,895	9,610	10.4	16.3	1.7	35.4
Ruanda-Urundi (Belgian Mandate)	1929	20,120	3,485	173.3	......	......	......
British Territory and Sphere of Influence:							
Anglo-Egyptian Sudan	1930	1,008,100	5,606	5.6	......	......	26.0
Basutoland	1931	11,716	650	55.5	......	......	......
Bechuanaland	1921	275,000	153	0.6	......	......	......
British East Africa	1931	686,956	15,894	23.1	......	......	......
Kenya	1931	225,100	3,041	13.5	......	......	47.5
Tanganyika (Mandate)	1931	366,632	5,064	15.0	......	......	14.3
Uganda Protectorate	1931	94,204	3,554	37.7	......	......	(see Kenya)
Zanzibar Protectorate	1931	1,020	235	....	......	......	6.2
Pemba	1931	380	97	255.3	......	......	......
Zanzibar	1931	640	138	215.6	......	......	......
British Somaliland	1931	68,000	345	5.1	......	......	......
British West Africa	1931	499,623	16,278	32.6	......	......	......
Gambia	1931	4,002	200	50.0	......	......	2.3
Gold Coast, Ashanti and Northern Territory	1931	91,690	3,124	34.1	......	7.3	40.1
Nigeria	1931	372,674	19,928	53.4	......	4.9	58.4
Northern Nigeria	1931	281,778	11,435	40.6	......	......	......
Southern Nigeria	1931	90,896	8,493	93.4	......	......	......
Sierre Leone	1931	30,931	1,672	54.1	......	......	7.8
Cameroons (Mandate)	1931	34,236	700	20.4	......	......	......
Mauritius	1931	720	393	545.8	......	......	14.4
Northern Rhodesia	1931	287,950	1,345	4.6	......	......	......
Nyasaland Protectorate	1931	47,949	1,603	33.4	......	......	4.9
St. Helena	1931	47	4	85.1	......	......	......
Southern Rhodesia	1931	150,344	1,109	7.4	......	1.6	23.4
South West Africa (Union of South Africa Mandate)	1931	322,393	241	0.8	......	......	14.0
Swaziland	1931	6,704	125	18.6	......	......	......
Togoland (Mandate)	1931	13,240	294	22.2	......	......	......
Union of South Africa	1932	471,917	8,251	17.5	62.8	22.2	251.8

62. COUNTRIES OF THE WORLD—(Continued)

Country	Year	Area, Square Miles	Total Population (thousands)	Population per Square Mile	Millions of Dollars: 1928 Trade with United States	1932 Trade with United States	Total Imports and Exports
AFRICA—*Continued*							
Cape of Good Hope	1932	276,536	3,164	11.4	......	......	......
Natal	1932	35,284	1,721	48.7	......	......	......
Orange Free State	1932	49,647	762	15.3	......	......	......
Transvaal	1932	110,450	2,604	23.6	......	......	......
French Sphere of Influence:							
Algeria	1931	222,206	6,553	29.5	18.2	1.4	314.3
Cameroon (Mandate)	1931	166,489	2,192	13.2	......	......	6.1
French Equatorial Africa	1931	915,057	3,192	3.4	......	......	13.4
French West Africa	1931	1,799,100	14,576	8.1	......	......	40.0
Dakar and Dependencies	1931	61	54	885.0	......	......	......
Dahomey	1931	47,142	1,112	23.5	......	......	......
French Guinea	1931	96,852	2,237	23.0	......	......	......
French Sudan	1931	561,303	2,856	5.0	......	......	......
Ivory Coast	1931	125,067	1,866	14.9	......	......	......
Mauritania	1931	322,335	324	1.0	......	......	......
Niger	1931	455,405	1,543	3.3	......	......	......
Senegal	1931	77,750	1,584	20.3	......	......	......
Upper Volta	1931	113,185	3,000	26.4	......	......	......
Madagascar	1931	238,013	3,759	15.7	0.5	0.4	26.0
Morocco	1931	162,162	5,057	31.2	4.0	5.4	96.9
Somali Coast	1931	8,880	69	7.8	......	......	18.2
Togoland (Mandate)	1931	20,077	750	37.3	......	......	......
Tunisia	1931	48,332	2,411	49.9	4.0	2.5	118.3
Italian Sphere of Influence:							
Eritrea	1931	45,754	622	13.5	......	......	......
Italian Somaliland	1931	194,000	1,011	5.2	......	......	......
Libya	1931	633,100	706	1.1	......	......	......
Cirenaica	1931	285,640	165	0.6	......	......	......
Tripolitania	1931	347,500	541	1.6	......	......	......
Portuguese Sphere of Influence:							
Angola (Portuguese West Africa)	1931	486,079	4,182	8.6	......	......	......
Mozambique (Portuguese East Africa)	1931	297,894	3,996	13.4	......	3.5	19.5
Portuguese Guinea	1930	13,944	365	26.2	......	......	......
Spanish Sphere of Influence:							
Rio de Oro, Adrar and Ifni	1927	110,165	22	0.2	......	......	......
Spanish Guinea	......	10,036	140	13.9	......	......	......
Spanish Morocco	1931	13,125	717	54.6	......	......	......

63. HIDES AND SKINS PRODUCED BY COUNTRIES

United States (cattle and calves contributed most)	38,712,000
U. S. S. R. (Russia) (skins rank first)	29,467,000
United Kingdom (sheep and lambs rank first)	15,493,000
Argentina (cattle and calves rank first)	14,150,000

64. PIG IRON PRODUCTION (thousands of long tons)

Country	1870	1910	1929	1932
United States	1.7	27.9	42.3	8.8
Germany	1.2	12.9	13.1	3.9
France	1.2	4.0	10.2	5.4
United Kingdom	6.0	10	7.6	3.6
Belgium	0.6	1.8	4.0	2.7
U. S. S. R. (Russia)	0.3	3.0	4.2	6.1

65. PRODUCTION OF LEATHER BY COUNTRIES

(Million dollars)

United States	481
Germany	218
United Kingdom	200
France	165
U. S. S. R. (Russia)	120

66. PRICE OF ALUMINUM A POUND

Year		Year	
1852	$545.00	1896	$0.30
1855	113.30	1900	0.23
1858	11.33	1905	0.40
1886	7.94	1909	0.22
1890	2.38	1914	0.19
1891	0.91	1923	0.25
1894	0.45	1931	0.229
1895	0.34		

67. MERCHANDISE EXPORTS FROM THE UNITED STATES TO LEADING COUNTRIES

(Millions of dollars)

Country	1928	1933
United Kingdom	847.3	311.7
Canada	914.7	210.5
Japan	288.2	143.4
Germany	467.3	140.0
France	240.7	121.7
Italy	162.1	61.2
China	137.7	51.9
Netherlands	142.3	48.7
Philippine Islands	78.8	44.8
Belgium	111.8	43.3
Mexico	115.7	37.5
Argentina	178.9	36.9
Spain	86.6	30.8
Brazil	100.1	29.7
Australia	141.4	26.3
Cuba	127.9	25.1
Union of South Africa	57.0	22.0
British India	53.7	19.9
Sweden	57.3	18.6
Colombia	58.6	14.8
Venezuela	37.9	13.1
Denmark	47.2	11.6
Total Merchandise Exports	5,128.4	1,675.0

68. MERCHANDISE IMPORTS INTO THE UNITED STATES FROM LEADING COUNTRIES

(Millions of dollars)

Country	1928	1933
Canada	489.3	185.1
Japan	384.5	128.4
United Kingdom	348.5	111.2
Philippine Islands	115.6	93.0
Brazil	220.7	82.6
Germany	222.1	78.2
British Malaya	204.4	59.9
Cuba	202.8	58.4
France	158.7	49.7
Colombia	94.6	47.6
British India	148.9	43.8
Italy	101.7	38.6
China	140.0	37.8
Argentina	99.4	33.8
Netherland India	86.1	33.1
Sweden	46.1	31.0
Netherlands	83.6	30.9
Mexico	124.5	30.7
Belgium	75.1	23.2
Czechoslovakia	36.8	14.6
Switzerland	42.9	14.5
Spain	35.0	13.7
Venezuela	38.9	13.5
Norway	21.7	13.2
Chile	75.2	11.5
Soviet Russia in Europe	13.9	11.4
Total General Imports	4,091.4	1,449.2

69. LEADING IMPORTS OF THE UNITED STATES

(Millions of dollars)

Commodity	1928	1933
Coffee	309.6	124.1
Cane sugar	207.0	107.6
Silk, raw	368.0	102.5
Paper and manufactures	156.4	77.4
Newsprint	139.4	68.5
Paper base stocks	112.3	65.3
Wood pulp	83.5	57.4
Chemicals and related products	143.2	59.9
Chemicals (coal tar, industrial, medicinal)	52.9	30.8
Fertilizers	78.5	24.6
Tin (bars, blocks, pigs)	87.0	51.2
Rubber, crude	244.9	45.9
Hides and skins	150.8	45.7
Furs and manufactures	121.7	38.1
Fruits and nuts	89.7	37.4
Vegetable oils expressed and fats	77.9	34.6
Cotton manufactures, including yarns	69.3	32.0
Oilseeds	60.7	26.7
Flaxseeds	31.2	13.5
Petroleum and products	132.8	25.9
Crude oil	90.5	17.7
Advanced and refined oils	40.9	7.2
Burlaps	80.1	24.4
Flax, hemp, and ramie manufactures	44.8	22.7
Fish	38.5	22.1
Tobacco, unmanufactured	55.2	21.5
Wool and mohair	79.9	21.5
Cacao	47.2	18.7
Copper, including ore and manufactures	98.2	17.6
Wool manufactures, including yarns	78.4	16.3
Art works	65.8	15.9
Vegetables and preparations	40.4	15.4
Tea	27.2	13.7
Wine and spirits	0.5	12.5
Sawmill products	54.9	12.3
Boards, planks, deals	40.4	8.2
Diamonds	57.1	11.3
Dairy products	34.2	11.0
Cheese	24.7	10.6
Nickel (ore, matte, alloys)	13.8	10.3
All other	943.9	307.7
Total General Imports	4,091.4	1,449.2

70. PRODUCTION AND CONSUMPTION OF WOOL BY COUNTRIES

(Million pounds)

Country	Production	Consumption
Australia	912.1	.....
United States	412.2	575.8
Argentina	351.0	.....
U. S. S. R. (Russia)	310.8	382.9
Union of South Africa	305.0	.....
France	.....	682.9
United Kingdom	.....	575.8

71. CLIMATIC DATA*	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Equatorial:													
Pará, Brazil	10.3	12.6	13.3	13.2	9.3	5.7	4.9	4.3	3.2	2.5	2.3	5.3	86.7
(1°28′ S.), (48°29′ W.), (33 ft.)	77.7	77.0	77.5	77.7	78.4	78.3	78.1	78.3	78.6	79.0	79.7	79.0	78.3
Batavia, Java	13.0	13.6	7.8	4.8	3.7	3.6	2.6	1.3	2.6	4.1	5.0	8.7	70.9
(6°16′ S.), (106°48′ E.), (23 ft.)	77.9	77.7	78.6	79.3	79.7	79.0	78.4	78.8	79.5	79.7	79.2	78.3	78.8
Tropical Grassland:													
Caracas, Venezuela	0.9	0.3	0.6	1.2	2.8	4.0	4.8	3.8	4.2	4.4	3.3	1.6	31.9
(10°30′ N.), (66°58′ W.), (3050 ft.)	68.5	68.9	68.3	72.5	73.9	73.0	72.0	72.7	72.5	71.4	71.2	78.9	71.2
Daly Waters, Australia	6.1	6.7	5.0	1.0	0.2	0.3	0.1	0.1	0.3	0.8	2.2	4.1	26.9
(16°19′ S.), (33°28′ E.), (700 ft.)	86.8	85.5	83.8	80.4	74.7	70.4	68.3	72.8	79.8	86.1	88.3	88.1	80.4
Mediterranean:													
Gibraltar	4.3	3.5	4.4	2.8	1.7	0.4	0.0	0.1	0.2	3.3	4.5	6.1	32.3
(36°8′ N.), (5°40′ W.), (49 ft.)	54.0	55.0	56.3	60.6	64.6	70.2	73.9	74.3	71.1	64.8	59.0	54.7	63.1
Sacramento, United States of America	3.8	2.9	3.0	1.6	0.8	0.1	0.0	0.0	0.2	0.9	2.1	4.0	19.4
(38°35′ N.), (121°30′ W.), (71 ft.)	45.6	50.2	54.2	58.0	62.9	68.9	72.5	72.1	69.1	62.2	53.4	46.3	59.6
Santiago, Chile	0.0	0.1	0.2	0.6	2.3	3.2	3.4	2.4	1.2	0.6	0.2	0.2	14.4
(33°28′ S.), (70°45′ W.), (1703 ft.)	67.7	68.8	63.2	56.7	51.7	58.3	46.9	48.4	54.5	56.3	61.3	65.2	55.6
Alaska-Norway:													
Bergen, Norway	6.9	5.6	4.3	3.8	4.1	4.4	5.9	6.9	8.3	8.8	6.7	7.4	73.1
(60°24′ N.), (5°22′ E.), (66 ft.)	34.2	33.6	35.4	42.1	48.9	55.0	57.9	57.6	52.7	45.1	38.5	34.7	44.6
Sitka, Alaska	7.1	6.8	5.6	5.4	4.3	3.5	4.0	7.1	9.7	11.7	8.8	7.4	81.4
(57°10′ N.), (135°30′ W.), (10 ft.)	30.2	31.8	34.5	39.7	45.9	51.3	54.5	54.7	50.5	43.9	37.4	32.9	42.2
English Channel:													
London, England	1.8	1.7	1.7	1.7	1.8	2.3	2.6	2.4	2.0	2.7	2.3	2.1	25.1
(51°25′ N.), (0°20′ E.), (111 ft.)	38.7	40.0	42.5	47.4	52.6	59.2	62.8	61.7	57.1	49.2	43.5	39.3	49.5
Victoria, British Columbia	4.8	3.5	2.5	1.7	1.2	1.0	0.4	0.6	1.8	2.9	5.5	5.6	30.5
(48°25′ N.), (123°21′ W.), (85 ft.)	40.1	41.6	44.2	48.9	53.5	56.1	60.8	60.2	56.6	51.5	45.8	42.8	50.3
Valdivia, Chile	2.9	3.2	6.4	9.3	15.3	17.5	15.4	13.5	7.3	5.0	4.4	4.8	105.0
(39°45′ S.), (73°10′ W.), (141 ft.)	59.5	58.9	56.6	53.5	51.4	48.5	46.0	46.3	49.3	51.1	53.2	56.6	52.6
Tropic Upland:													
Sao Paulo, Brazil	8.2	8.1	5.9	2.6	3.0	2.6	0.8	2.1	3.2	4.8	4.5	6.1	51.9
(23°31′ S.), (46°31′ W.), (2495 ft.)	71.1	70.7	70.0	65.7	61.2	57.9	57.6	60.1	61.9	64.6	66.7	70.0	64.8
Guatemala City, Guatemala	0.3	0.2	0.5	1.5	5.6	11.5	8.0	8.0	9.2	6.7	0.9	0.2	52.4
(14°37′ N.), (90°30′ W.), (4855 ft.)	61.3	62.8	65.7	66.2	68.0	66.2	65.8	66.0	65.7	64.8	62.8	61.3	64.8
Addis Ababa, Ethiopia (Abyssinia)	0.6	1.5	2.8	3.2	2.5	5.6	11.2	11.9	6.4	0.6	0.7	0.1	47.1
(9°2′ N.), (38°49′ E.), (8000 ft.)	61.9	59.4	64.0	61.2	63.2	59.2	56.7	58.9	58.0	60.0	61.4	60.0	60.2
Spring Wheat:													
Bismarck, North Dakota	0.5	0.5	1.1	1.8	2.4	3.4	2.2	2.0	1.2	1.0	0.7	0.6	17.4
(46°49′ N.), (100°46′ W.), (1674 ft.)	7.0	9.6	22.7	42.9	54.3	63.4	69.3	67.6	57.7	44.7	27.3	15.4	40.0
St. Paul, Minn. (*Southern Edge*)	0.9	0.8	1.4	2.4	3.4	4.1	3.5	3.5	3.4	2.6	1.4	1.0	27.8
(44°57′ N.), (93°5′ W.), (848 ft.)	11.9	15.4	28.2	45.8	57.7	67.3	72.0	69.7	60.5	48.4	31.0	18.8	43.9
Edmonton, Alberta, Can. (*Northern Edge*)	0.9	0.6	0.7	0.8	1.8	3.2	3.5	2.4	1.4	0.7	0.7	0.8	17.5
(53°45′ N.), (113°30′ W.), (5050 ft.)	5.5	10.5	23.4	40.5	51.0	57.3	61.1	59.2	50.2	41.1	24.7	14.3	36.5
Saratov, Russia	0.9	0.8	0.7	1.1	1.1	1.5	1.7	1.3	1.2	1.5	1.4	1.6	14.9
(51°30′ N.), (45°55′ E.), (295 ft.)	11.5	14.9	23.9	41.0	58.6	67.1	72.1	68.9	57.4	43.3	28.9	17.6	42.1
Harbin, Manchuria	0.2	0.3	0.3	1.0	1.8	4.0	5.9	4.1	2.1	1.2	0.4	0.2	21.5
(45°40′ N.), (126°31′ E.), (525 ft.)	1.7	5.4	24.1	42.3	55.9	66.0	72.1	69.4	57.9	40.1	21.2	3.2	37.9
Trade Wind Shores:													
Rio de Janeiro, Brazil	5.0	4.3	5.3	4.4	3.5	2.0	1.6	1.8	2.6	3.2	4.3	5.4	43.4
(23°0′ S.), (43°20′ W.), (197 ft.)	77.5	78.1	77.2	74.1	70.7	68.2	67.5	68.7	69.4	71.2	73.4	74.8	72.5
Kingston, Jamaica (Cane-Sugar Climate)	1.0	0.7	1.0	1.0	4.6	4.4	1.8	3.9	4.2	8.1	3.0	1.8	35.6
(17°59′ N.), (76°49′ W.), (60 ft.)	75.7	75.7	76.5	78.3	79.9	81.1	81.7	81.0	80.6	79.3	78.6	76.8	78.8
Great Northern Forests:													
Dawson City, Canada	1.0	0.7	0.6	0.7	1.0	1.1	1.8	1.6	1.9	1.3	1.2	1.1	14.0
(64°5′ N.), (139°31′ W.), (1200 ft.)	*23.9*	*13.5*	3.0	28.2	47.5	57.9	59.7	54.8	41.9	27.1	*0.7*	*9.8*	24.2
Corn Belt:													
Rosario, Argentina	3.7	3.2	5.3	3.1	1.8	1.5	1.0	1.5	1.6	3.5	3.4	5.3	34.9
(33°0′ S.), (60°45′ W.), (95 ft.)	76.5	75.7	70.0	62.4	55.9	43.3	51.6	52.3	57.0	62.2	69.4	74.7	63.0
Bucuresti, Rumania	1.2	1.1	1.7	2.0	2.5	3.3	2.8	1.9	1.5	1.5	1.9	1.7	23.1
(44°25′ N), (26°7′ E.), (279 ft.)	25.5	29.3	39.7	51.8	61.3	68.2	73.0	71.4	63.7	53.6	40.5	30.2	50.7
Small Grain and Potato:													
Boston, Mass.	3.7	3.5	4.1	3.8	3.7	3.1	3.5	4.2	3.4	3.7	4.1	3.8	44.6
(42°15′ N.), (71°0′ W.), (124 ft.)	27.0	28.0	35.0	45.3	56.6	65.8	71.3	68.9	62.7	52.3	41.2	31.6	48.8
Rice:													
Calcutta, India	0.2	0.2	0.8	3.7	9.0	36.5	29.4	14.9	7.4	9.1	3.8	1.3	116.2
(22°30′ N.), (88°30′ E.), (21 ft.)	77.8	79.8	81.6	83.6	83.1	78.5	76.7	77.4	78.3	79.1	79.5	78.3	79.5
Pasture Plains:													
Albuquerque, New Mexico	0.4	0.2	0.2	0.5	0.4	0.8	1.2	1.3	0.9	0.7	0.5	0.4	7.5
(35°5′ N.), (106°39′ W.), (5200 ft.)	33.8	39.3	47.2	55.7	64.7	73.4	77.1	75.3	67.8	56.6	43.3	34.4	55.7
Santa Cruz, Argentina	0.5	0.3	0.2	0.6	0.7	0.4	1.1	0.4	0.2	0.4	0.4	1.0	6.0
(47°30′ S.), (70°0′ W.), (85 ft.)	60.6	57.4	53.6	48.2	40.8	34.2	33.1	38.3	43.0	47.8	54.7	55.2	47.3

* Latitude, longitude, and elevation are given directly after the name of each city. Rainfall is shown in the upper line; temperature in the lower line. Below zero temperatures are shown in italics.

72. AVERAGE COMPOSITION OF NUTS AND OTHER FOODS

Kind of Food	Refuse, Per Cent	Water, Per Cent	Protein, Per Cent	Fat, Per Cent	Sugar, Starch, Per Cent	Crude Fiber, Per Cent	Ash, Per Cent	Fuel Value per Pound, Calories
Meat, Round Steak	.....	65.5	19.8	13.6	....	....	1.1	950
Cheese, Cheddar	.....	27.4	27.7	36.8	4.1	....	4.0	2,145
Eggs, boiled	11.20	65.0	12.4	10.7	....	....	0.7	680
Beans, dried	.....	12.6	22.5	1.8	35.2	4.4	3.5	1,605
Soy beans	.....	10.8	34.0	16.8	33.7	....	4.7	1,970
Wheat flour, high grade	.....	12.0	11.4	1.0	74.8	0.3	0.5	1,650
Cornmeal, unbolted	10.9	10.3	7.5	4.2	65.9	....	1.2	1,545
Oatmeal, boiled	.....	84.5	2.8	0.5	11.5	....	0.7	285
Rice	.....	12.3	8.0	0.3	78.8	0.2	0.4	1,630
Potatoes	20.00	78.3	2.2	0.1	18.0	0.4	1.0	385
Sweet potatoes	20.00	69.0	1.8	0.7	26.1	1.3	1.1	570
Apples	25.00	84.6	0.4	0.5	13.0	1.2	0.3	290
Raisins	10.00	14.6	2.6	3.3	73.6	2.5	3.4	1,605
Grapes	22.00	81.9	1.4	1.4	14.4	0.5	0.4	355
Oranges	28.00	87.2	0.9	0.2	10.6	0.6	0.4	230
Persimmons, native	18.00	64.4	0.8	0.4	32.0	1.5	0.9	640
Dates	10.00	15.4	2.1	2.8	78.4	....	1.3	1,615
Olives, ripe	19.00	64.7	1.7	25.9	4.3	....	3.4	1,205
Cabbage	15.00	77.7	1.4	0.2	4.8	....	0.9	125
Figs, dried	.....	18.8	4.3	0.3	74.2	....	2.4	1,475
Avocado	25.00	65.4	1.7	26.4	3.3	1.8	1.4	1,200
*"Biotes"	35.6	2.6	5.2	24.1	30.9	....	1.6	1,690
Brazil nut	49.35	4.7	17.4	65.0	5.7	3.9	3.3	3,120
Chestnut, dry	23.40	6.1	10.7	7.8	70.1	2.9	2.4	1,840
Coconut	34.66	13.0	6.6	56.2	13.7	8.9	1.6	2,805
Pecan	50.10	3.4	12.1	70.7	8.5	3.7	1.6	3,300
Walnut (Persian)	58.80	3.4	18.2	60.7	13.7	2.3	1.7	3,075
Peanut butter	.....	2.1	29.3	46.5	17.1		5.0	2,825
Chestnut flour	.....	7.8	4.6	3.4	80.8		3.4	1,780

* Acorns (*Quercus emori*) as sold and used by Indians of northern Mexico and southern Arizona.

73. WATER POWER BY STATES, DEVELOPED AND UNDEVELOPED

(Thousands of horse power)

State	Developed (capacity of actual installation)	Potential (available 50 per cent of the time)	State	Developed (capacity of actual installation)	Potential (available 50 per cent of the time)
Washington	1,053	11,225	Virginia	155	812
California	2,448	6,674	Texas	53	614
Oregon	364	5,894	Wisconsin	524	480
New York	1,900	4,960	Minnesota	287	401
Idaho	348	4,032	Iowa	184	395
Montana	429	3,700	Nevada	14	370
Arizona	137	2,887	Illinois	94	361
Colorado	102	1,609	New Hampshire	559	350
Utah	158	1,586	Nebraska	24	342
Wyoming	23	1,182	Arkansas	95	300
North Carolina	971	1,160	Kentucky	145	280
Maine	613	1,074	Michigan	444	274
Alabama	931	1,050	Kansas	16	251
Pennsylvania	478	1,000	Maryland and District of Columbia	422	238
West Virginia	87	980	Massachusetts	368	235
Georgia	512	958	South Dakota	20	203
Tennessee	288	882			
South Carolina	810	860			

74. USEFUL BOOKS

For the Teacher Desiring More Material

1. **Climatic Regions.** Descriptions of conditions in climatic regions similar to those in this book.
   JONES, W., AND WHITTLESEY, D., *An Introduction to Economic Geography;* University of Chicago Press.

2. **World Industries.** Leading industries and world trade on plan much like that of this book.
   SMITH, J. RUSSELL, *Industrial and Commercial Geography;* Henry Holt & Co., N. Y.

3. **The Problems of the Nations.** International problems that make news usually have their causes explained in
   BOWMAN, I., *The New World;* World Book Co., Yonkers, N. Y.

4. **North America.** Living conditions and industries in the different regions of the continent.
   SMITH, J. RUSSELL, *North America;* Harcourt, Brace, N. Y.

5. **South America.** Living conditions and industries in the different regions of the continent.
   JONES, C. F., *South America;* Henry Holt & Co., N. Y.
6. **Europe.** A full presentation of each country.
   BLANCHARD, W. O., AND VISHER, S. S., *Economic Geography of Europe;* McGraw-Hill, N. Y.
7. **Asia.** A wealth of information about every country.
   STAMP, DUDLEY, *Asia;* Dutton, N. Y.
8. **Africa.**
   SUGGATE, L. S., *Africa;* Harrap, London.
9. **Australia.** An excellent geography of the continent.
   TAYLOR, G., *Australia;* Oxford University Press, N. Y.

FOR THE STUDENT

(*a*) *Industries, Occupations, and Activities of Man.*

Dozens of Industries, each having two to five pages.

RUSH, C. E., AND WINSLOW, A., *Modern Aladdins and Their Magic. The Science of Things About Us,* 318 pp.; Little, Brown & Co., Boston.

This book covers so much ground that it is the most important single book for student reference.

CRUMP, IRVING, *The Boy's Book of Forest Rangers,* 253 pp. Dodd, Mead & Co., N. Y.

SMITH, J. RUSSELL, *The Story of Iron and Steel,* 193 pp.; D. Appleton, N. Y.

WATSON, E., *The Story of Textiles,* 83 pp.; Harper & Bro., N. Y.

BASSETT, S. W., *The Story of Wool;* Penn Publishing Co., Philadelphia.

BASSETT, S. W., *The Story of Silk;* Penn Publishing Co., Philadelphia.

CHAMBERLAIN, J. F., *How We Are Clothed;* Macmillan Co., N. Y.

KIPLING, RUDYARD. Fishing: *Captains Courageous;* Doubleday, Doran, N. Y.

HULBERT, W. D., *Forest Neighbors;* Row, Peterson & Co., N. Y.

SAMUEL, E. I., *The Story of Gold and Silver;* Penn Publishing Co., Philadelphia.

HULBERT, A. B., *Forty-Niners,* 340 pp.; Little, Brown & Co., Boston.

VAN METRE, T. W., *Trains, Tracks, and Travel,* 236 pp.; Simmons, Boardman, N. Y.

VAN METRE, T. W., *Ships: Tramps and Liners,* 324 pp.; Doubleday, Doran, N. Y.

MOONEY, JAMES E., *Air Travel,* a brief history of flying, 311 pp.; Charles Scribner's Sons, N. Y.

Any Topic:

WINSTON'S CUMULATIVE LOOSE-LEAF ENCYCLOPEDIA, John C. Winston Company, Philadelphia.

COMPTON'S PICTURED ENCYCLOPEDIA (Vol. VII, pp. 2749-55), (on coal and other fuels), F. E. Compton & Co., Chicago.

THE BOOK OF KNOWLEDGE (Vol. XIII, pp. 4533-52), (on coal and other fuels), Grolier Society, N. Y.

(*b*) *Books of Travel and Exploration That Give Feeling for Geographic Backgrounds*

Great Northern Forest, Canada; Fur Trapping, Caribou Hunting, Sled Dog, Pack Dog:

INGSTAD, H., *The Land of Feast and Famine,* 322 pp.; Knopf, N. Y.

O'BRIEN, JACK, *Silver Chief, Dog of the North,* 224 pp.; John C. Winston Company, Philadelphia.

Himalaya Mountains, Turkestan, Nomad Shepherds, Yaks, Oases, Bazaars, Hunting:

ROOSEVELT, T. AND K., *East of the Sun and West of the Moon,* 284 pp.; Scribners, N. Y.

Nomads of the High Pastures of Central Asia:

The Road to the Grey Pamir, 289 pp.; Little, Brown, Boston.

Africa: Tropic Grasslands, Lions, Forests, Pygmies:

HOEFLER, P., *Africa Speaks,* 469 pp.; John C. Winston Company, Philadelphia.

Africa: Grassland and Mountain Forest:

AKELEY, CARL AND MARY, *Lions and Gorillas and Their Neighbors,* 260 pp.; Dodd, Mead & Co., N. Y.

China:

LEWIS, ELIZABETH FOREMAN, *Young Fu of the Upper Yangtze,* 272 pp.; The John C. Winston Company, Philadelphia.

Equatorial Forest—the Terrible Ants:

BEEBE, W., *Edge of the Jungle* (Chs. 7, 8), 303 pp.; Henry Holt, N. Y.

Argentine Pampa, Andean Plateau, Tropic Lowland Forest:

TSCHIFFELY, A. F., *Tschiffely's Ride* (Horseback, Buenos Aires to Texas), 328 pp.; Simon & Schuster, N. Y.

Italy, Its Towns, Facts and Stories:

UNTERMEYER, L., *The Donkey of God,* 300 pp.; Harcourt, Brace, N. Y.

The South Sea Islands—Pearl Diving, Life of Boat People:

NORDHOFF, C., *The Pearl Lagoon,* 224 pp.; Little, Brown & Co., Boston.

PINCHOT, GIFFORD, JR., *Giff and Stiff in the South Seas,* 254 pp.; The John C. Winston Company, Philadelphia.

Tundra and Arctic Seashore:

STEFANSSON, V., *Hunters of the Great North;* Harcourt, Brace, N. Y.

MACMILLAN, D. B., *The Life of a North Greenland Boy, Kah-da,* 237 pp.; Doubleday, Doran, N. Y.

Whales and Antarctic Seas:

VILLIERS, A. J., *Whaling in the Frozen South;* 302 pp.; Robert M. McBride & Co., N. Y.

MELVILLE, HERMAN, *Moby Dick, the White Whale,* 432 pp.; The John C. Winston Company, Philadelphia.

Persia, Rugs, Nomads, Village Life:

MIRZA, Y. B., *Myself When Young,* 260 pp.; Doubleday, Doran, N. Y.

Brazil—Exploration in Tropic Grassland and Equatorial Forest:

FLEMING, PETER, *Brazilian Adventure,* 444 pp.; Charles Scribner's Sons, N. Y.

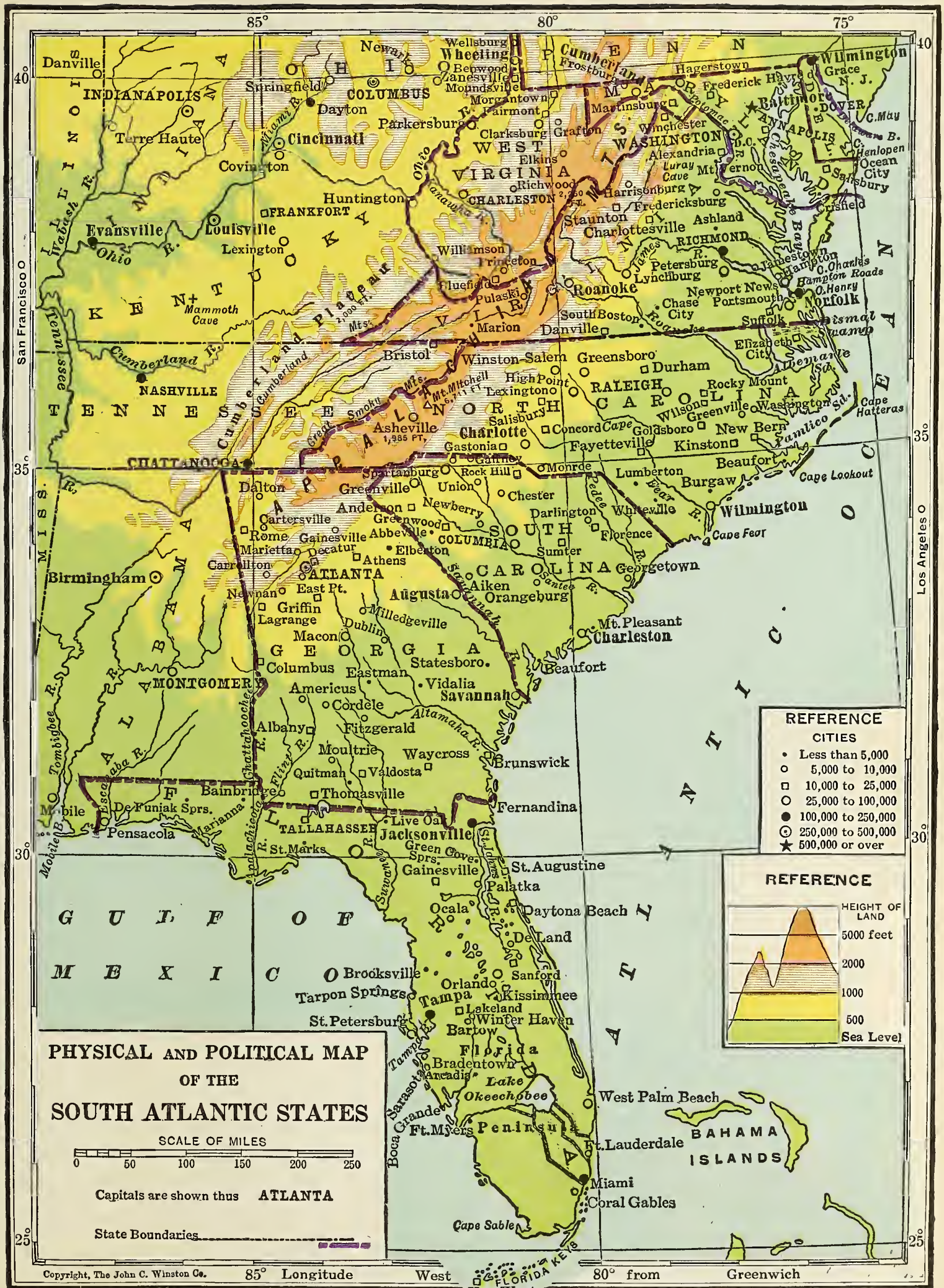
The Colorado Plateau and the Terrible Power of Water:

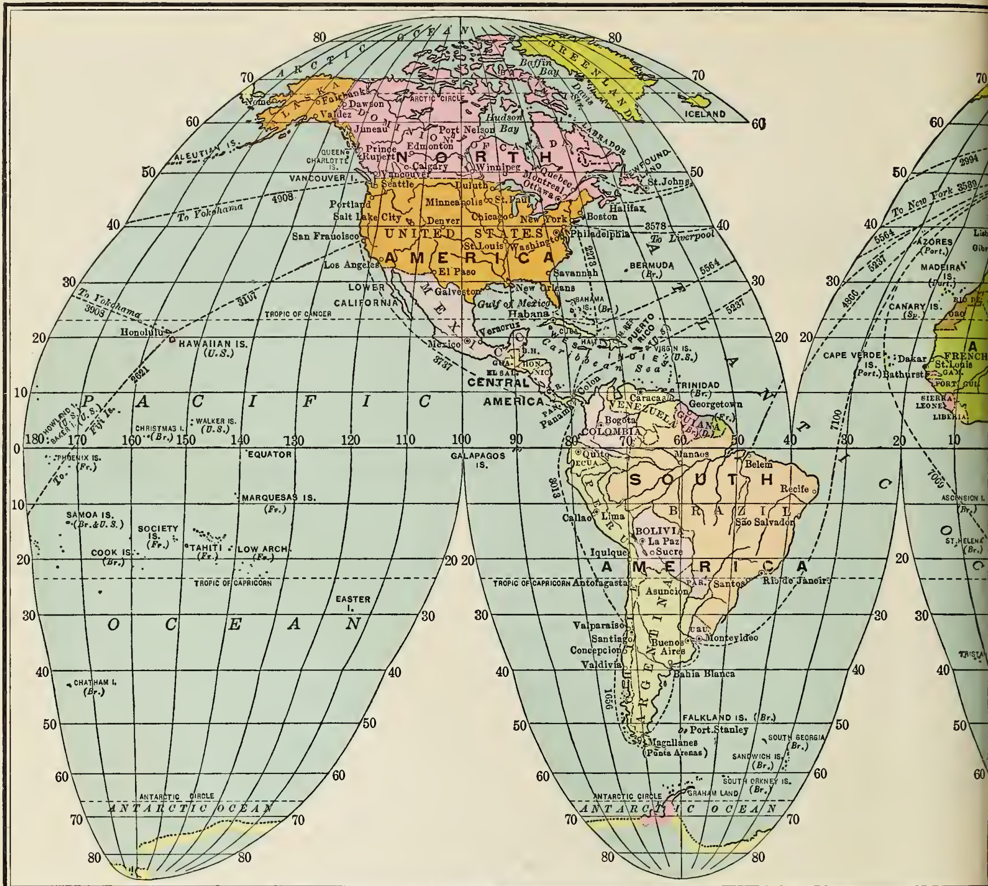
EDDY, CLYDE, *Down the World's Most Dangerous River,* 293 pp.; F. A. Stokes, N. Y.

INDEX

Explanation of Symbols: Geographic and proper names are indexed in black-face type, (**Aachen**), other subjects in light-face, (abaca). References to the map plates which follow this index are given by Roman figures in parentheses with map finders, as (XV O2). Other map references are given by italic figures in parentheses, as (*67*). The more important discussions of subjects are indicated by black-face figures, as **171**. Other references are in light-face figures, as 172. Illustrations are shown by italic figures with asterisk, as **170*.

Key to Pronunciation: āte. senāte, râre, căt, locȧl, fär, ȧsk, pȧrade; scēne, ēvent, ĕdge, novẹl, refẽr; rīght, sĭn; cōld, ōbey, côrd, stŏp, cŏmpare; ūnit, ūnite, bûrn, cŭt, focŭs, menü; bo͞ot, fo͝ot; found; boil; fuṅction; chase; good; joy; *th*en, thick; hw = wh as in when; zh = z as in azure; kh = ch as in loch.


PHYSICAL AND POLITICAL MAP
OF THE
SOUTH ATLANTIC STATES
SCALE OF MILES
0 50 100 150 200 250
Capitals are shown thus ATLANTA
State Boundaries
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
REFERENCE
HEIGHT OF LAND
5000 feet
2000
1000
500
Sea Level
85° Longitude West 80° from Greenwich
San Francisco
Los Angeles
GULF OF MEXICO
ATLANTIC OCEAN
BAHAMA ISLANDS
FLORIDA KEYS
Key West
KENTUCKY
TENNESSEE
WEST VIRGINIA
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
Florida
Peninsula
Copyright, The John C. Winston Co.
2
3
4



POLITICAL MAP OF THE WORLD

ON GOODE'S HOMOLOSINE EQUAL AREA PROJECTION

Distances shown in statute miles

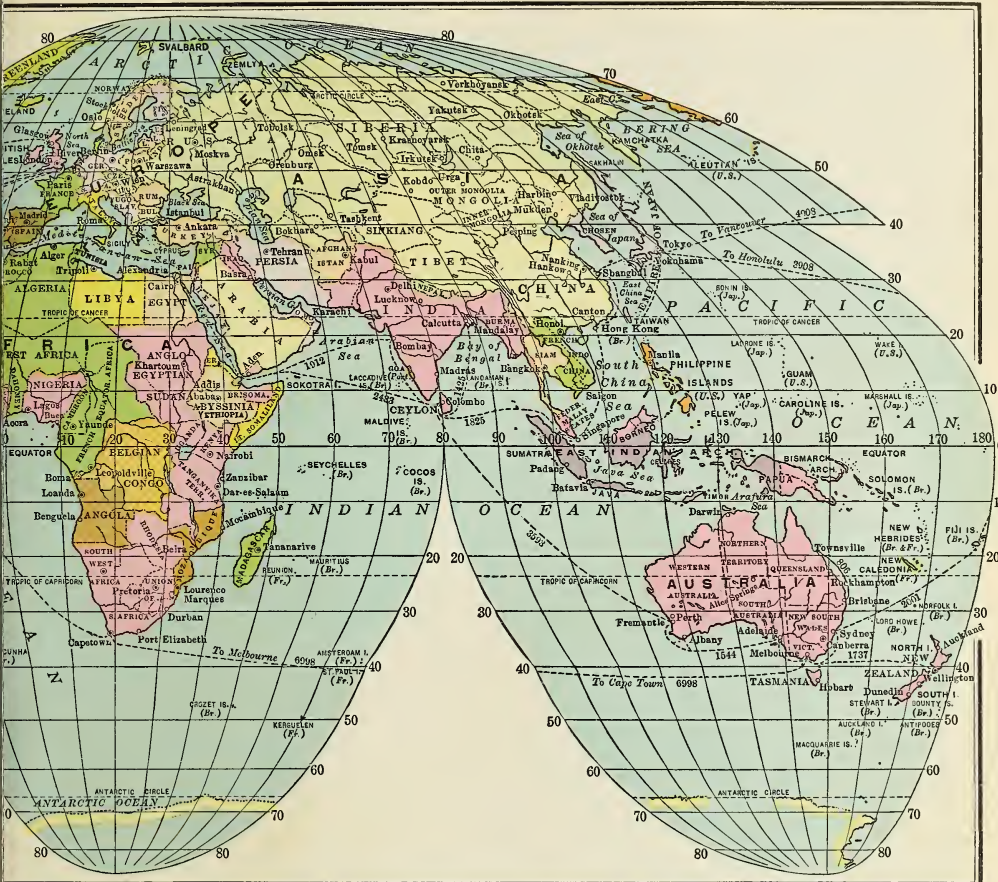
SCALE OF MILES

0 500 1000 1500 2000 2500 3000

COLONIAL POSSESSIONS

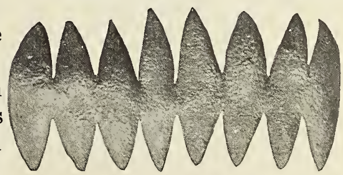
United States	*Portugal*
Great Britain	*Spain*
France	*Netherlands*
Italy	*Denmark*
Belgium	

The Homolosine projection by Professor John Paul Goode is an equal area projection; that is, a square inch anywhere on the map represents the same number of square miles of the earth's surface as any other square inch on the map. For this reason areas of countries may be shown upon it without error. The continents are given better form than in any other world map projection. It is greatly superior to Mercator's projection for nearly all teaching purposes.



The world is round, like an orange. Maps are flat, like sheets of paper. How can we show the surface of the round globe on the flat map? That is a hard problem.

The best way to get an idea of this problem is to skin an orange carefully in one piece and spread the skin out flat like the one shown here.



It is not hard to do. It shows you how the surface of a globe looks when spread out flat.

Professor J. Paul Goode did something like that with the skin of a globe when he made this map. He has stretched it a little to get it flat, but this map shows all the different countries and continents in true relative size, and more nearly in their true shape than any other flat map of the whole world shows them. That is why we use it here. It is the truest map there is—of the whole world—on one sheet.

PLATE III

ARCTIC OCEAN
ATLANTIC OCEAN
PACIFIC
GREENLAND
Interior of Greenland entirely covered with ice
ICELAND
Reykjavik
Denmark Strait
Angmagsalik
Sydproven
Ivigtut
Frederickshaab
Davis Strait
Upernivik
Etah
BAFFIN BAY
ARCTIC ARCHIPELAGO
Hudson Strait
HUDSON BAY
BELCHER IS.
Churchill
Port Nelson
LABRADOR
NEWFOUNDLAND
St. Johns
Cape Race
ST. PIERRE
MIQUELON
Str. of Belle Isle
Gulf of St. Lawrence
C. BRETON I.
PR. EDWARD I.
NOVA SCOTIA
Halifax
Cape Sable
B. of Fundy
St. Johns
Boston
Cape Cod
New York
Philadelphia
Quebec
Montreal
Ottawa
Toronto
L. Ontario
Buffalo
L. Erie
Pittsburgh
Cleveland
Detroit
L. Huron
L. Michigan
Chicago
Sudbury
L. Superior
St. Paul
Minneapolis
Mississippi R.
Red R.
Winnipeg
Lake Winnipeg
L. Manitoba
L. Winnipegosis
Regina
Nelson R.
The Pas
Saskatchewan R.
Churchill R.
Reindeer L.
L. Athabaska
McMurray
Athabaska R.
Edmonton
Calgary
Peace R.
Vermilion
Great Slave Lake
Ft. Smith
Great Bear Lake
ARCTIC CIRCLE
Simpson
Norman
Mackenzie R.
DOMINION OF CANADA
ROCKY MTS.
Missouri R.
Butte
Helena
Spokane
Snake R.
Boise
Great Salt
Fraser R.
Prince George
Prince Rupert
Vancouver
Victoria
VANCOUVER I.
Cape Flattery
Seattle
Portland
Columbia R.
Cape Mendocino
QUEEN CHARLOTTE IS.
Ketchikan
Wrangell
Juneau
Douglas
Sitka
Skagway
Whitehorse
Mt. St. Elias 18,024
Dawson
Yukon R.
Fairbanks
ALASKA
Alaska Range
Mt. McKinley 20,300
Mt. Sushitna
Valdez
Cordova
Seward
Kenai Pen.
Cook Inlet
KODIAK I.
Alaska Pen.
Kuskokwim R.
Nome
St. Michael
Bering Strait
ST. LAWRENCE I.
BERING SEA
ASIA


PHYSICAL AND POLITICAL MAP
OF
NORTH AMERICA
SCALE OF MILES
0 100 200 300 400 500 600
Railroads
REFERENCE
HEIGHT OF LAND
10000 feet
5000
2000
1000
500
Sea Level
Below Sea Level
Copyright, The John C. Winston Co.
Longitude West from Greenwich
120° 110° 100° 90° 80°
30° 20° 10° 0°
EQUATOR
TROPIC OF CANCER
UNITED STATES
MEXICO
CENTRAL AMERICA
SOUTH AMERICA
GULF OF MEXICO
CARIBBEAN SEA
PACIFIC OCEAN
ATLANTIC
BERMUDA IS.
BAHAMA ISLANDS
Nassau
CUBA
Habana (Havana)
Santiago de Cuba
JAMAICA
Kingston
HAITI
DOMINICAN REPUBLIC
Port au Prince
Santo Domingo
PUERTO RICO
San Juan
Florida Strait
FLORIDA KEYS
Key West
Yucatan Channel
YUCATAN
Progreso
Belize
BRIT. HONDURAS
GUATEMALA
Guatemala
EL SALVADOR
San Salvador
HONDURAS
Tegucigalpa
NICARAGUA
Managua
COSTA RICA
San José
PANAMA
Panama
Colon
Panama Canal
Washington
Norfolk
Cape Hatteras
Wilmington
Cape Fear
Charleston
Savannah
Jacksonville
Atlanta
Tampa
Cincinnati
St. Louis
Ohio R.
Memphis
Birmingham
Mississippi
New Orleans
Galveston
Austin
Fort Worth
Red R.
Kansas City
Arkansas
Oklahoma City
Platte R.
Denver
Salt Lake City
Santa Fe
Grand Canyon
Colorado
El Paso
Rio Grande
Chihuahua
Durango
Tampico
Veracruz
Guadalajara
Mexico
Popocatepetl
Acapulco
Salina Cruz
Sierra Madre
Gulf of California
Cape San Lucas
Sierra Nevada
San Francisco
Los Angeles

PLATE IV

M
N
O
P
Q
R
2
3
4
5
6
7
130°
125°
120°
115°
110°
105°
100°
45°
40°
35°
30°
25°
D O M I N I O N
Str. of Juan
C. Flattery
Vancouver
Victoria
Seattle
WASHINGTON
Aberdeen
Olympia
Tacoma
Mt. Rainier
Spokane
Columbia R.
Portland
Columbia
Salem
OREGON
CASCADE
Boise
IDAHO
Snake
Pocatello
GLACIER NATIONAL PARK
MONTANA
Missouri
Helena
Butte
Yellowstone
ROCKY
NORTH DAKOTA
Devils L.
Bismarck
James
SOUTH DAKOTA
Pierre
BLACK HILLS
Sioux
YELLOWSTONE NATIONAL PARK
WYOMING
Casper
Granger
Cheyenne
NEBRASKA
Platte R.
Mt. Shasta
Cape Mendocino
Sacramento R.
Sacramento
San Francisco
San Joaquin R.
CALIFORNIA
COAST
RANGES
GREAT BASIN
Reno
Carson City
NEVADA
YOSEMITE NATIONAL PARK
SIERRA NEVADA
Mt. Whitney
Great Salt Lake
Ogden
Salt Lake City
UTAH
Colorado R.
MOUNTAINS
Denver
COLORADO
Pikes Peak
Pueblo
Kansas R.
KANSAS
Wichita
GRAND CANYON
ARIZONA
Phoenix
Tucson
Santa Fe
Albuquerque
NEW MEXICO
Llano Estacado
Oklahoma City
OKLA
SANTA BARBARA ISLANDS
Los Angeles
San Diego
Salton Sea
El Paso
TEXAS
Edwards Plateau
Austin
San Antonio
Rio Grande
Brownsville
LOWER CALIFORNIA
Gulf of California
SIERRA MADRE
MEXICO
PACIFIC OCEAN
TROPIC OF CANCER
Copyright, The John C Winston Co.
Longitude
West

PLATE IV


PHYSICAL AND POLITICAL MAP
OF THE
UNITED STATES
SCALE OF MILES
0 50 100 200 300 400
National Capitals
State Capitals
State Boundaries
International Boundaries
Railroads
REFERENCE
HEIGHT OF LAND
10000 feet
5000 "
2000 "
2000 feet
1000 "
500 "
Sea Level
Below Sea Level (Only in S.Calif.)
GULF OF MEXICO
ATLANTIC OCEAN
CANADA
BAHAMA ISLANDS
TROPIC OF CANCER
from 95° Greenwich 90° 85° 80° 75°


N
O
P
1
2
3
4
PHYSICAL AND POLITICAL MAP
OF THE
PACIFIC STATES
SCALE OF MILES
0 50 100 150 200 250 300
Capitals are shown thus SALEM
Limits of Great Basin
State Boundaries
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
REFERENCE
HEIGHT OF LAND
11000 feet
5000
2000
1000
500
Sea Level
Below Sea Level
125°
120°
115°
110°
45°
40°
35°
Longitude West from Greenwich
BRITISH COLUMBIA
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
CALIFORNIA
ARIZONA
MEXICO
PACIFIC OCEAN
GREAT BASIN
Seattle To Yokohama 4900 Miles
Seattle To Honolulu 2774 Miles
To Yokohama 5223 Miles
To Honolulu 2408 Miles
San Francisco to New York via Panama Canal 6059 Miles
Vancouver
Victoria
Bellingham
Anacortes
Everett
Port Angeles
Seattle
Tacoma
Bremerton
Hoquiam
Aberdeen
OLYMPIA
Puyallup
Centralia
Chehalis
Raymond
Longview
Astoria
St. Helens
Portland
Oregon City
Vancouver
Hood River
The Dalles
Pendleton
La Grande
Baker
Oroville
Colville
Spokane
Hillyard
Wenatchee
Ellensburg
Yakima
Lewiston
Pullman
Walla Walla
Mt. Baker 10,827 FT.
Mt. Rainier 14,408 FT.
Mt. St. Helens 9,671 FT.
Mt. Adams 12,307 FT.
Mt. Hood 11,225
Mt. Jefferson 10,523 FT.
McMinnville
SALEM
Albany
Lebanon
Corvallis
Eugene
Prineville
Bend
Burns
Roseburg
North Bend
Marshfield
Grants Pass
Medford
Ashland
Klamath Falls
Lakeview
CRATER LAKE NAT. PARK
Crescent City
Yerka
Mt. Shasta 14,380 FT.
Arcata
Eureka
Redding
Red Bluff
Lassen Vol. 10,577 FT.
Susanville
Ft. Bragg
Willits
Chico
Grass Valley
Reno
Sparks
Lakeport
Marysville
CARSON CITY
Virginia City
Santa Rosa
SACRAMENTO
Napa
Vallejo
Richmond
Berkeley
Stockton
Modesto
San Francisco
Oakland
Alameda
Palo Alto
Santa Clara
San Jose
Santa Cruz
Salinas
Monterey
Gonzales
Fresno
YOSEMITE NATIONAL PARK
Mt. Lyell 13,090 FT.
Mt. Tyndall 14,386 FT.
Mt. Whitney 14,502 FT.
SEQUOIA NAT. PARK
Paso Robles
San Luis Obispo
Bakersfield
Santa Barbara
Glendale
Pasadena
Santa Monica
Los Angeles
Huntington Park
Long Beach
Pomona
San Bernardino
Redlands
Riverside
Ontario
Santa Ana
San Diego
El Centro
Yuma
Winnemucca
Elko
Ely
Tonopah
Goldfield
Las Vegas
Nampa
BOISE
Twin Falls
Pocatello
Idaho Falls
YELLOWSTONE NATIONAL PARK
Ogden
SALT LAKE CITY
Great Salt Lake
Great Salt Lake Desert
GRAND CANYON NAT. PARK
Jerome
Prescott
PHOENIX
Mohave Desert
Death Valley
Salton Sea
Imperial Valley
Colorado Desert
Colorado Plateau
Copyright, The John C. Winston Co.

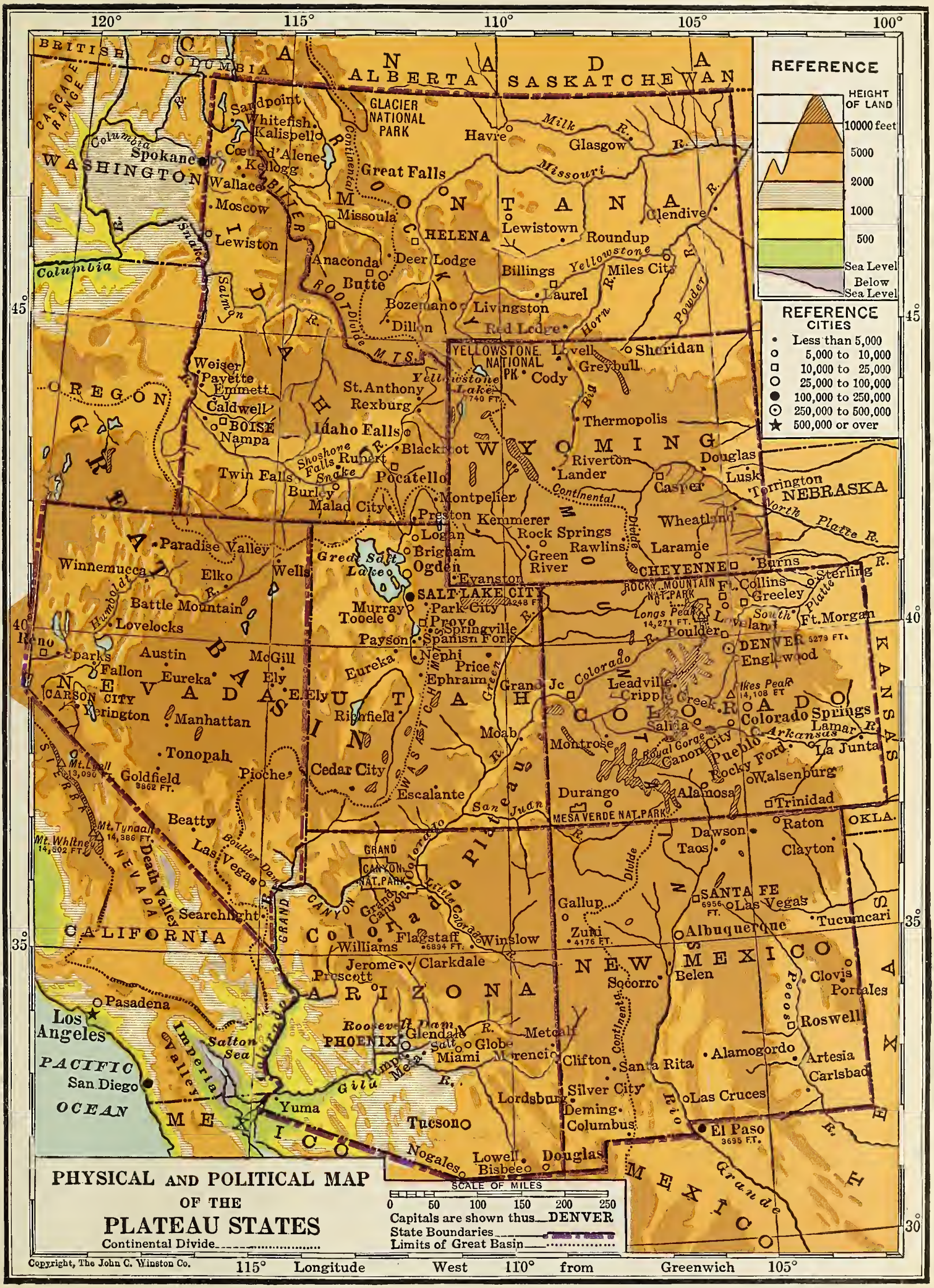
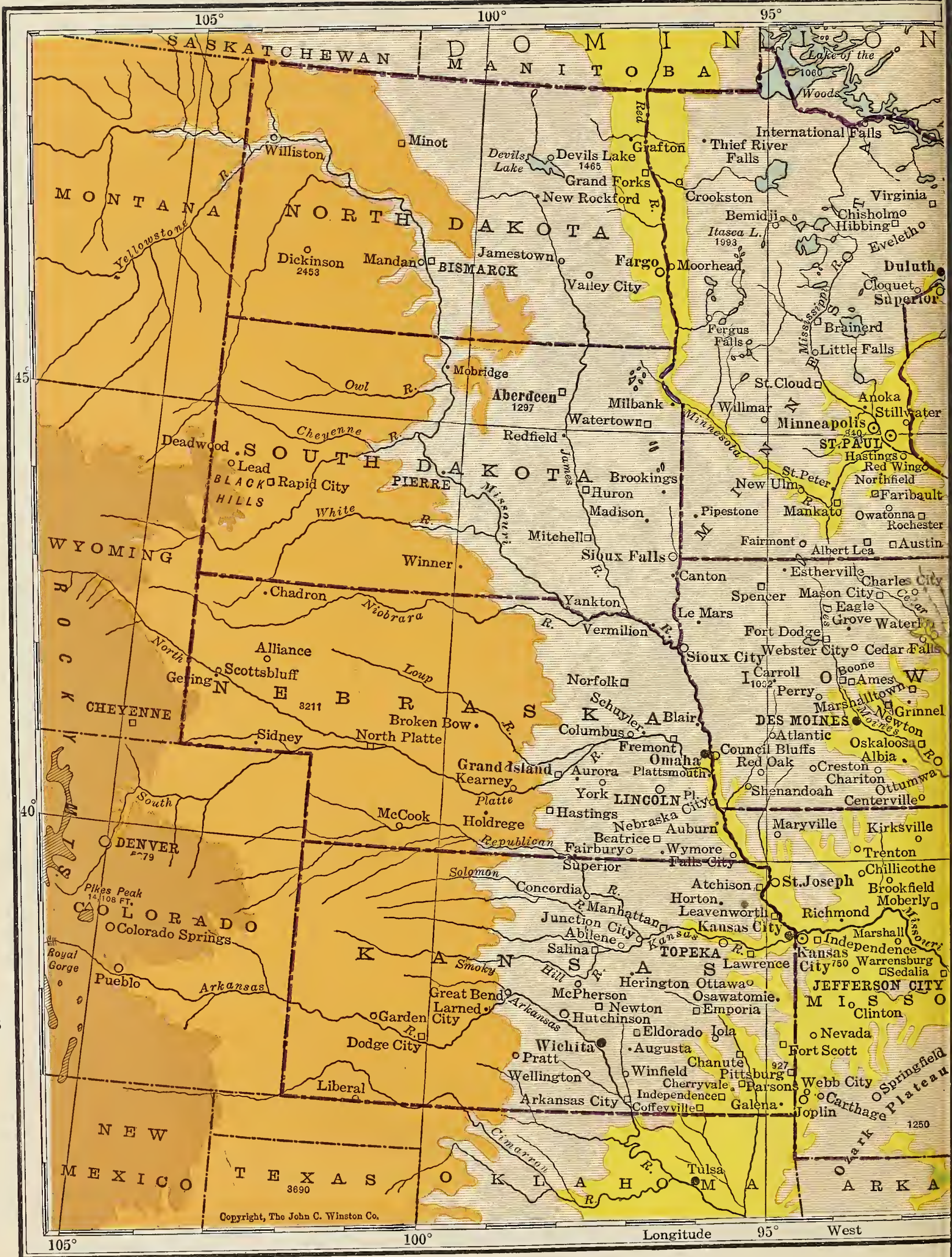

M
N
O
P
1
2
3
4
120°
115°
110°
105°
100°
45°
40°
35°
30°
REFERENCE
HEIGHT OF LAND
10000 feet
5000
2000
1000
500
Sea Level
Below Sea Level
REFERENCE CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
BRITISH COLUMBIA
CANADA
ALBERTA
SASKATCHEWAN
CASCADE RANGE
GLACIER NATIONAL PARK
WASHINGTON
MONTANA
IDAHO
OREGON
WYOMING
NEBRASKA
NEVADA
UTAH
COLORADO
KANSAS
OKLA.
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
MEXICO
PACIFIC OCEAN
GREAT BASIN
Colorado Plateau
YELLOWSTONE NATIONAL PK
ROCKY MOUNTAIN NAT. PARK
MESA VERDE NAT. PARK
GRAND CANYON NAT. PARK
Spokane
Sandpoint
Whitefish
Kalispell
Coeur d'Alene
Kellogg
Wallace
Moscow
Lewiston
Great Falls
Havre
Glasgow
Missoula
HELENA
Lewistown
Roundup
Glendive
Anaconda
Deer Lodge
Butte
Billings
Miles City
Laurel
Bozeman
Livingston
Dillon
Red Lodge
Sheridan
Lovell
Greybull
Cody
Thermopolis
Riverton
Lander
Douglas
Lusk
Casper
Torrington
Wheatland
Laramie
CHEYENNE
Rawlins
Rock Springs
Green River
Kemmerer
Evanston
Weiser
Payette
Emmett
Caldwell
BOISE
Nampa
St. Anthony
Rexburg
Idaho Falls
Blackfoot
Shoshone
Rupert
Pocatello
Twin Falls
Burley
Malad City
Montpelier
Preston
Logan
Brigham
Ogden
SALT LAKE CITY
Murray
Tooele
Park City
Provo
Springville
Spanish Fork
Payson
Nephi
Price
Ephraim
Eureka
Richfield
Grand Jc
Moab
Cedar City
Escalante
Winnemucca
Paradise Valley
Wells
Elko
Battle Mountain
Lovelocks
Reno
Sparks
Fallon
Austin
Eureka
McGill
Ely
CARSON CITY
Yerington
Manhattan
Tonopah
Goldfield
Pioche
Beatty
Las Vegas
Death Valley
Searchlight
Mt. Whitney 14,502 FT.
Mt. Tyndall 14,386 FT.
Burns
Ft. Collins
Greeley
Sterling
Ft. Morgan
Loveland
Boulder
Longs Peak 14,271 FT.
DENVER 5279 FT.
Englewood
Leadville
Cripple Creek
Pikes Peak 14,108 FT.
Colorado Springs
Salida
Montrose
Royal Gorge
Canon City
Pueblo
Rocky Ford
Lamar
La Junta
Walsenburg
Alamosa
Trinidad
Durango
Raton
Dawson
Taos
Clayton
SANTA FE 6956 FT.
Las Vegas
Tucumcari
Gallup
Zuni
Albuquerque
Belen
Socorro
Clovis
Portales
Roswell
Alamogordo
Artesia
Carlsbad
Santa Rita
Silver City
Deming
Columbus
Las Cruces
El Paso 3695 FT.
Lordsburg
Clifton
Morenci
Metcalf
Globe
Miami
Roosevelt Dam
PHOENIX
Glendale
Flagstaff 6894 FT.
Williams
Winslow
Jerome
Clarkdale
Prescott
Tucson
Nogales
Lowell
Bisbee
Douglas
Yuma
Pasadena
Los Angeles
San Diego
Salton Sea
Imperial Valley
PHYSICAL AND POLITICAL MAP OF THE PLATEAU STATES
Continental Divide
SCALE OF MILES
0 50 100 150 200 250
Capitals are shown thus DENVER
State Boundaries
Limits of Great Basin
Copyright, The John C. Winston Co.
115° Longitude West 110° from Greenwich 105°

PLATE VII



N
O
P
1
2
3
105°
100°
95°
45°
40°
SASKATCHEWAN
DOMINION
MANITOBA
Lake of the Woods
1060
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
NEBRASKA
COLORADO
KANSAS
NEW MEXICO
TEXAS
OKLAHOMA
MINNESOTA
IOWA
MISSOURI
ARKA
ROCKY MTS.
Yellowstone R.
Owl R.
Cheyenne R.
White R.
Niobrara R.
Loup R.
North Platte
South Platte
Republican
Solomon R.
Smoky Hill R.
Arkansas
Cimarron R.
Missouri
Red R.
Minnesota R.
Mississippi R.
James R.
Sioux R.
Des Moines
Cedar
Kansas R.
Minot
Williston
Devils Lake
Devils Lake 1465
Grafton
Grand Forks
New Rockford
Dickinson 2453
Mandan
BISMARCK
Jamestown
Valley City
Fargo
Moorhead
Thief River Falls
Crookston
International Falls
Bemidji
Itasca L. 1993
Virginia
Chisholm
Hibbing
Eveleth
Duluth
Cloquet
Superior
Brainerd
Fergus Falls
Little Falls
St. Cloud
Mobridge
Aberdeen 1297
Milbank
Watertown
Willmar
Anoka
Stillwater
Minneapolis 840
ST. PAUL
Hastings
Red Wing
Northfield
Faribault
Redfield
Deadwood
Lead
BLACK HILLS
Rapid City
PIERRE
Huron
Brookings
New Ulm
St. Peter
Madison
Pipestone
Mankato
Owatonna
Rochester
Mitchell
Fairmont
Albert Lea
Austin
Winner
Sioux Falls
Canton
Estherville
Charles City
Mason City
Chadron
Yankton
Spencer
Eagle Grove
Waterloo
Vermilion
Le Mars
Fort Dodge
Webster City
Cedar Falls
Sioux City
Alliance
Scottsbluff
Gering
Norfolk
Carroll 1032
Boone
Ames
Perry
Marshalltown
Grinnel
3211
CHEYENNE
Broken Bow
Schuyler
Blair
DES MOINES
Newton
Columbus
Atlantic
Oskaloosa
Sidney
North Platte
Fremont
Omaha
Council Bluffs
Red Oak
Albia
Grand Island
Kearney
Aurora
Plattsmouth
Creston
Chariton
Ottumwa
York
LINCOLN
Shenandoah
Centerville
Hastings
Nebraska City
Auburn
McCook
Holdrege
Beatrice
Maryville
Kirksville
DENVER
Fairbury
Wymore
Falls City
Trenton
Superior
Chillicothe
Pikes Peak 14,108 FT.
Concordia
Atchison
St. Joseph
Brookfield
Moberly
Manhattan
Horton
Leavenworth
Richmond
Colorado Springs
Junction City
Kansas City
Abilene
Marshall
Independence
Salina
TOPEKA
Lawrence
Royal Gorge
Pueblo
Herington
Ottawa
Warrensburg
Sedalia
JEFFERSON CITY
Great Bend
McPherson
Osawatomie
Larned
Newton
Emporia
Clinton
Garden City
Hutchinson
Eldorado
Iola
Nevada
Dodge City
Wichita
Augusta
Fort Scott
Pratt
Chanute
927
Pittsburg
Winfield
Wellington
Cherryvale
Parsons
Webb City
Independence
Liberal
Arkansas City
Coffeyville
Galena
Carthage
Joplin
Springfield
Ozark Plateau
1250
3690
Tulsa
Copyright, The John C. Winston Co.
Longitude
West


PHYSICAL AND POLITICAL MAP
OF THE
NORTH CENTRAL STATES
SCALE OF MILES
0 50 100 150 200
Capitals are shown thus ST.PAUL
State Boundaries
Canals
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
Over 500,000
REFERENCE
HEIGHT OF LAND
10000 feet
5000
2000
1000
500
Sea Level
from 90° Greenwich 85° 80°

PLATE VIII

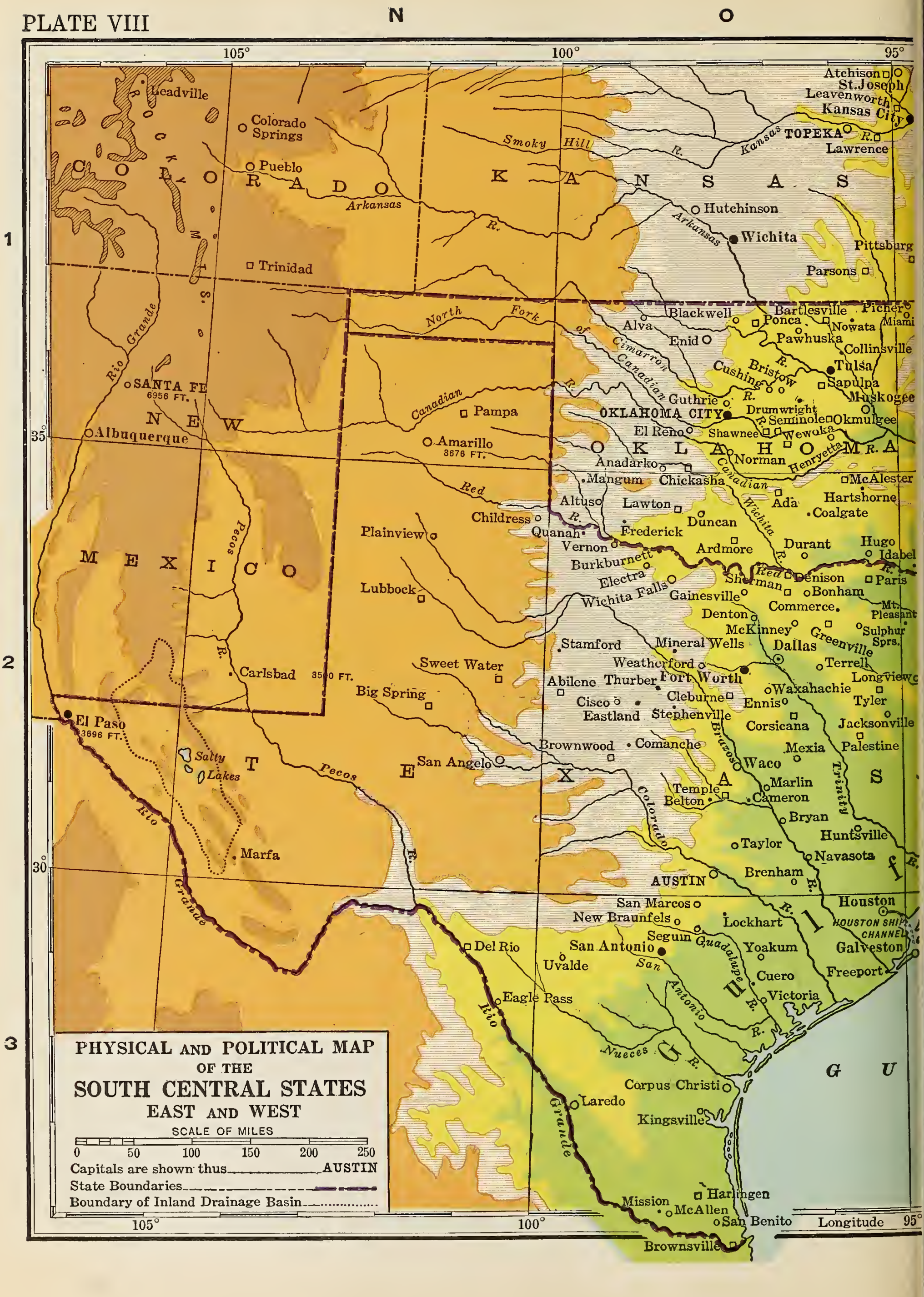
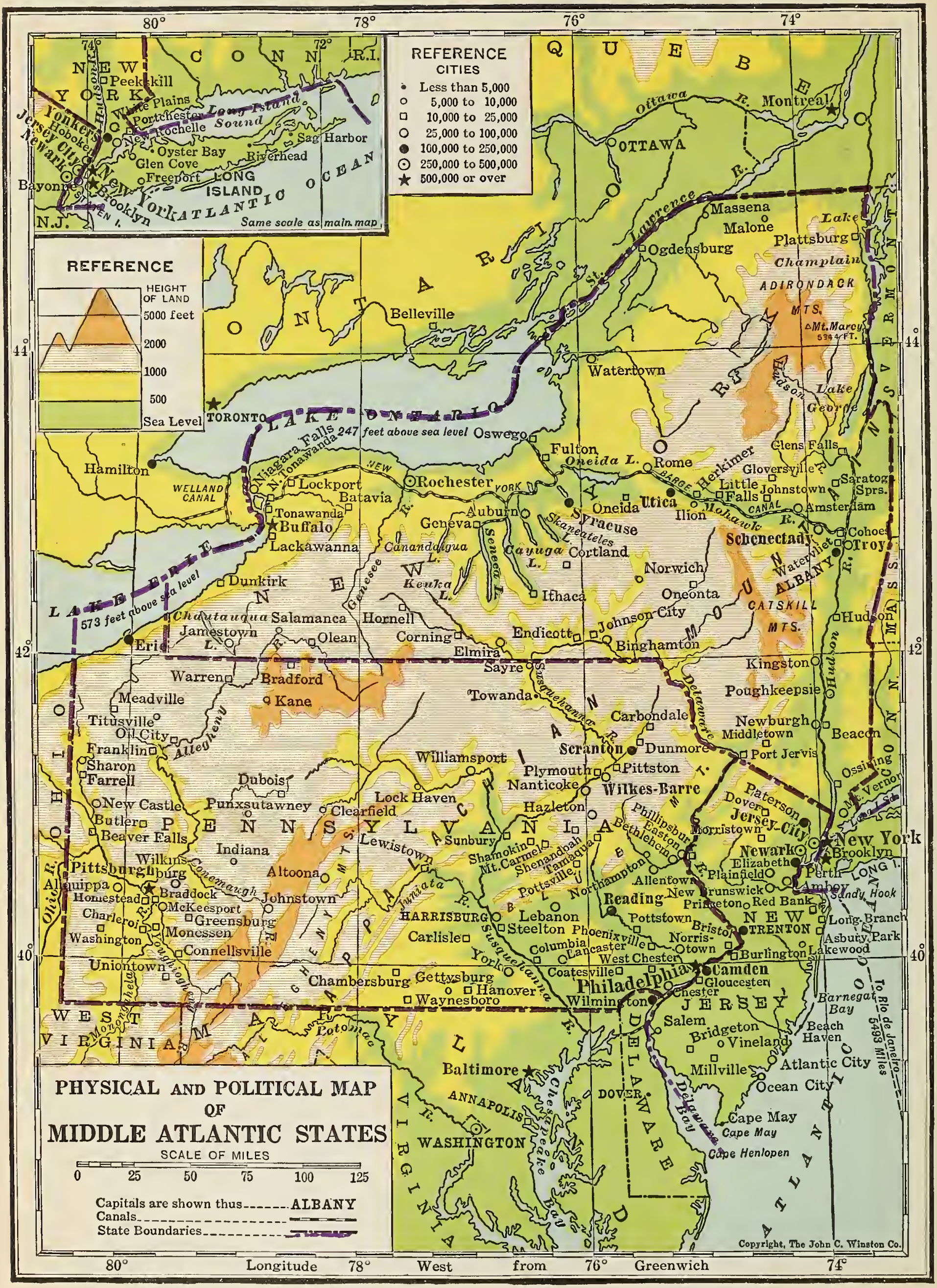

PHYSICAL AND POLITICAL MAP
OF THE
SOUTH CENTRAL STATES
EAST AND WEST
SCALE OF MILES
0 50 100 150 200 250
Capitals are shown thus AUSTIN
State Boundaries
Boundary of Inland Drainage Basin
N
O
1
2
3
105°
100°
95°
35°
30°
Longitude
COLORADO
KANSAS
NEW MEXICO
OKLAHOMA
TEXAS
GULF
ROCKY MTS.
Leadville
Colorado Springs
Pueblo
Trinidad
Arkansas R.
Smoky Hill R.
Kansas R.
Atchison
St. Joseph
Leavenworth
Kansas City
TOPEKA
Lawrence
Hutchinson
Wichita
Pittsburg
Parsons
Rio Grande
SANTA FE
6956 FT.
Albuquerque
North Fork of Canadian R.
Canadian
Cimarron
Pecos
Salty Lakes
Carlsbad
El Paso
3696 FT.
Marfa
Blackwell
Alva
Enid
Ponca
Bartlesville
Picher
Miami
Nowata
Pawhuska
Collinsville
Tulsa
Sapulpa
Muskogee
Okmulgee
Cushing
Bristow
Guthrie
Drumwright
OKLAHOMA CITY
Seminole
Wewoka
El Reno
Shawnee
Norman
Henryetta
Anadarko
Chickasha
McAlester
Hartshorne
Coalgate
Mangum
Altus
Lawton
Ada
Duncan
Frederick
Wichita R.
Pampa
Amarillo
3676 FT.
Red R.
Childress
Quanah
Vernon
Plainview
Burkburnett
Electra
Wichita Falls
Ardmore
Durant
Hugo
Idabel
Sherman
Denison
Paris
Bonham
Gainesville
Commerce
Mt. Pleasant
Sulphur Sprs.
Denton
McKinney
Greenville
Lubbock
Stamford
Mineral Wells
Dallas
Weatherford
Fort Worth
Terrell
Longview
Abilene
Thurber
Waxahachie
Tyler
Sweet Water
Big Spring
3500 FT.
Cisco
Eastland
Cleburne
Stephenville
Ennis
Corsicana
Jacksonville
Palestine
Brownwood
Comanche
Brazos R.
Mexia
Waco
San Angelo
Temple
Belton
Marlin
Cameron
Colorado R.
Trinity R.
Bryan
Huntsville
Taylor
Navasota
AUSTIN
Brenham
San Marcos
New Braunfels
Lockhart
Houston
HOUSTON SHIP CHANNEL
Galveston
Freeport
Seguin
Guadalupe R.
San Antonio
Yoakum
Cuero
Victoria
Del Rio
Uvalde
Eagle Pass
San Antonio R.
Nueces R.
Corpus Christi
Laredo
Kingsville
Harlingen
Mission
McAllen
San Benito
Brownsville

PLATE VIII


P
Q
R
90°
85°
1
2
3
MISSOURI
Kansas City
Sedalia
JEFFERSON CITY
St. Louis
455 FT
Springfield
Joplin
Ozark Plateau
1260 FT.
ILLINOIS
INDIANA
OHIO
Cincinnati
Dayton
Ft. Thomas
Covington
Newport
Maysville
Ashland
Catlettsburg
CHARLESTON
WEST VIRGINIA
FRANKFORT
Cynthiana
Paris
Winchester
Mt. Sterling
Louisville
Vincennes
New Albany
Georgetown
Lexington
Harrodsburg
Richmond
Evansville
Henderson
Owensboro
Danville
Jenkins
Hazard
Providence
Lebanon
Madisonville
Earlington
Central Cy.
Mammoth Cave
Princeton
Bowling Green
Somerset
Corbin
KENTUCKY
VIRGINIA
Middlesboro
Bristol
Kingsport
Johnson Cy.
Elizabethton
Greeneville
Cairo
322 FT.
Paducah
Mayfield
Fulton
Hopkinsville
Franklin
Clarksville
Springfield
La Follette
Morristown
Knoxville
Union Cy.
Paris
Dyersburg
Humboldt
NASHVILLE
Lebanon
Murfreesboro
Harriman
Rockwood
Alcoa
Maryville
GREAT SMOKY MTS.
Mt. Mitchell
6,711 FT.
Asheville
1985 FT.
NORTH CAROLINA
Cumberland Plateau
2000 FT.
Lenoir Cy.
Cleveland
Chattanooga
Columbia
Tullahoma
Fayetteville
TENNESSEE
Jackson
Brownsville
Covington
Blytheville
Memphis
273 FT.
Rogers
Harrison
Yellville
Fayetteville
Paragould
Jonesboro
Batesville
Newport
Forrest City
Van Buren
Russellville
Morrilton
Conway
Fort Smith
ARKANSAS
LITTLE ROCK
Little Rock
N. Marianna
Helena
Stuttgart
Mena
Hot Springs
Malvern
Pine Bluff
Arkadelphia
Hope
Camden
Texarkana
El Dorado
Ouachita
Holly Springs
Corinth
New Albany
Oxford
Tupelo
Clarksdale
Water Valley
Grenada
Okolona
Aberdeen
Charleston
West Point
Greenwood
Columbus
Greenville
Lexington
Macon
Yazoo City
Canton
JACKSON
Meridian
329 FT.
Vicksburg
Laurel
Ellisville
Natchez
Brookhaven
Hattiesburg
McComb
Columbia
MISSISSIPPI
Gulfport
Biloxi
Moss Pt.
Pascagoula
Bay St. Louis
Sheffield
Tuscumbia
Florence
Muscle Shoals
Athens
Huntsville
Decatur
Tarrant City
Birmingham
Fairfield
Brighton
Bessemer
Jasper
Northport
Tuscaloosa
Blocton
Greensboro
Demopolis
Attalla
Alabama City
Gadsden
Anniston
Talladega
Roanoke
Lanett
Opelika
Phenix City
Prattville
Selma
MONTGOMERY
Union Springs
Greenville
Troy
Eufaula
Andalusia
Enterprise
Florala
Dothan
Brewton
Mobile
Mobile Bay
ALABAMA
Tombigbee R.
Rome
Athens
ATLANTA
Macon
Columbus
GEORGIA
SOUTH CAROLINA
Savannah R.
Chattahoochee
Flint
FLORIDA
TALLAHASSEE
Pensacola
Apalachicola R.
Perdido R.
Escambia R.
LOUISIANA
Homer
Minden
Ruston
Bastrop
Monroe
Shreveport
Mansfield
Winnfield
Natchitoches
Alexandria
Nacogdoches
Lufkin
De Ridder
Opelousas
Eunice
Beaumont
21 FT.
Orange
Lake Charles
22 FT.
La Fayette
Jennings
Crowley
Donaldsonville
Kentwood
Bogalusa
BATON ROUGE
Hammond
Plaquemine
L. Pontchartrain
Port Arthur
Abbeville
New Iberia
Morgan City
Houma
Gretna
New Orleans
Mouths of the Mississippi
GULF OF MEXICO
Mississippi R.
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
REFERENCE
HEIGHT OF LAND
10000 feet
5000
2000
1000
500
Sea Level
Copyright, The John C. Winston Co.
West from Greenwich 90°
85°

PLATE IX


N
O
P
Q
1
2
3
4
PHYSICAL AND POLITICAL MAP OF MIDDLE ATLANTIC STATES
SCALE OF MILES
0 25 50 75 100 125
Capitals are shown thus ALBANY
Canals
State Boundaries
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
REFERENCE
HEIGHT OF LAND
5000 feet
2000
1000
500
Sea Level
Same scale as main map
80°
78°
76°
74°
72°
44°
42°
40°
Longitude West from Greenwich
Copyright, The John C. Winston Co.
NEW YORK
CONN.
R.I.
N.J.
Peekskill
White Plains
Portchester
Long Island Sound
New Rochelle
Yonkers
Hoboken
Jersey City
Newark
Bayonne
Oyster Bay
Glen Cove
Freeport
Riverhead
Sag Harbor
LONG ISLAND
New York
Brooklyn
ATLANTIC OCEAN
QUEBEC
ONTARIO
OTTAWA
Ottawa R.
Montreal
St. Lawrence R.
Massena
Malone
Plattsburg
Ogdensburg
Lake Champlain
ADIRONDACK MTS.
Mt. Marcy 5344 FT.
Belleville
Watertown
Lake George
Hudson R.
TORONTO
LAKE ONTARIO
247 feet above sea level
Oswego
Fulton
Oneida L.
Rome
Herkimer
Glens Falls
Gloversville
Little Falls
Johnstown
Saratoga Sprs.
Amsterdam
Hamilton
WELLAND CANAL
Niagara Falls
N. Tonawanda
Lockport
Rochester
NEW YORK BARGE CANAL
Batavia
Tonawanda
Buffalo
Lackawanna
Auburn
Geneva
Syracuse
Oneida
Utica
Ilion
Mohawk R.
Schenectady
Cohoes
Troy
Watervliet
ALBANY
Skaneateles L.
Canandaigua L.
Seneca L.
Cayuga L.
Cortland
Norwich
Genesee R.
Keuka L.
Ithaca
Oneonta
LAKE ERIE
573 feet above sea level
Dunkirk
Chautauqua L.
Jamestown
Salamanca
Hornell
Olean
Corning
Elmira
Endicott
Johnson City
Binghamton
CATSKILL MTS.
Hudson
Kingston
Poughkeepsie
Newburgh
Middletown
Beacon
Port Jervis
Ossining
Mt. Vernon
Erie
Warren
Bradford
Kane
Meadville
Titusville
Oil City
Franklin
Sharon
Farrell
Allegheny R.
Sayre
Towanda
Susquehanna R.
Carbondale
Scranton
Dunmore
Delaware R.
Williamsport
Plymouth
Pittston
Nanticoke
Wilkes-Barre
Dubois
Lock Haven
Clearfield
Punxsutawney
New Castle
Butler
Beaver Falls
Hazleton
PENNSYLVANIA
Paterson
Dover
Jersey City
Morristown
Newark
Elizabeth
Phillipsburg
Easton
Bethlehem
Allentown
Indiana
Lewistown
Sunbury
Shamokin
Mt. Carmel
Shenandoah
Tamaqua
Pottsville
Northampton
Plainfield
Perth Amboy
New Brunswick
Princeton
Red Bank
Sandy Hook
Long Branch
Asbury Park
Lakewood
Pittsburgh
Wilkinsburg
Aliquippa
Homestead
Braddock
McKeesport
Charleroi
Washington
Monessen
Greensburg
Connellsville
Uniontown
Altoona
Johnstown
Conemaugh R.
Juniata R.
HARRISBURG
Carlisle
Steelton
Lebanon
Reading
Pottstown
Phoenixville
Norristown
Bristol
TRENTON
Burlington
Columbia
Lancaster
West Chester
York
Coatesville
Philadelphia
Camden
Gloucester
Chester
Wilmington
Chambersburg
Gettysburg
Hanover
Waynesboro
ALLEGHENY MTS.
APPALACHIAN MTS.
BLUE MT.
WEST VIRGINIA
Monongahela R.
Youghiogheny R.
Potomac R.
Ohio R.
OHIO
MARYLAND
Baltimore
ANNAPOLIS
WASHINGTON
VIRGINIA
Chesapeake Bay
DOVER
DELAWARE
Delaware Bay
NEW JERSEY
Salem
Bridgeton
Vineland
Millville
Barnegat Bay
Beach Haven
Atlantic City
Ocean City
Cape May
Cape Henlopen
To Rio de Janeiro 5493 Miles
VERMONT
MASSACHUSETTS
CONNECTICUT
LONG I.
Long I. Sd.

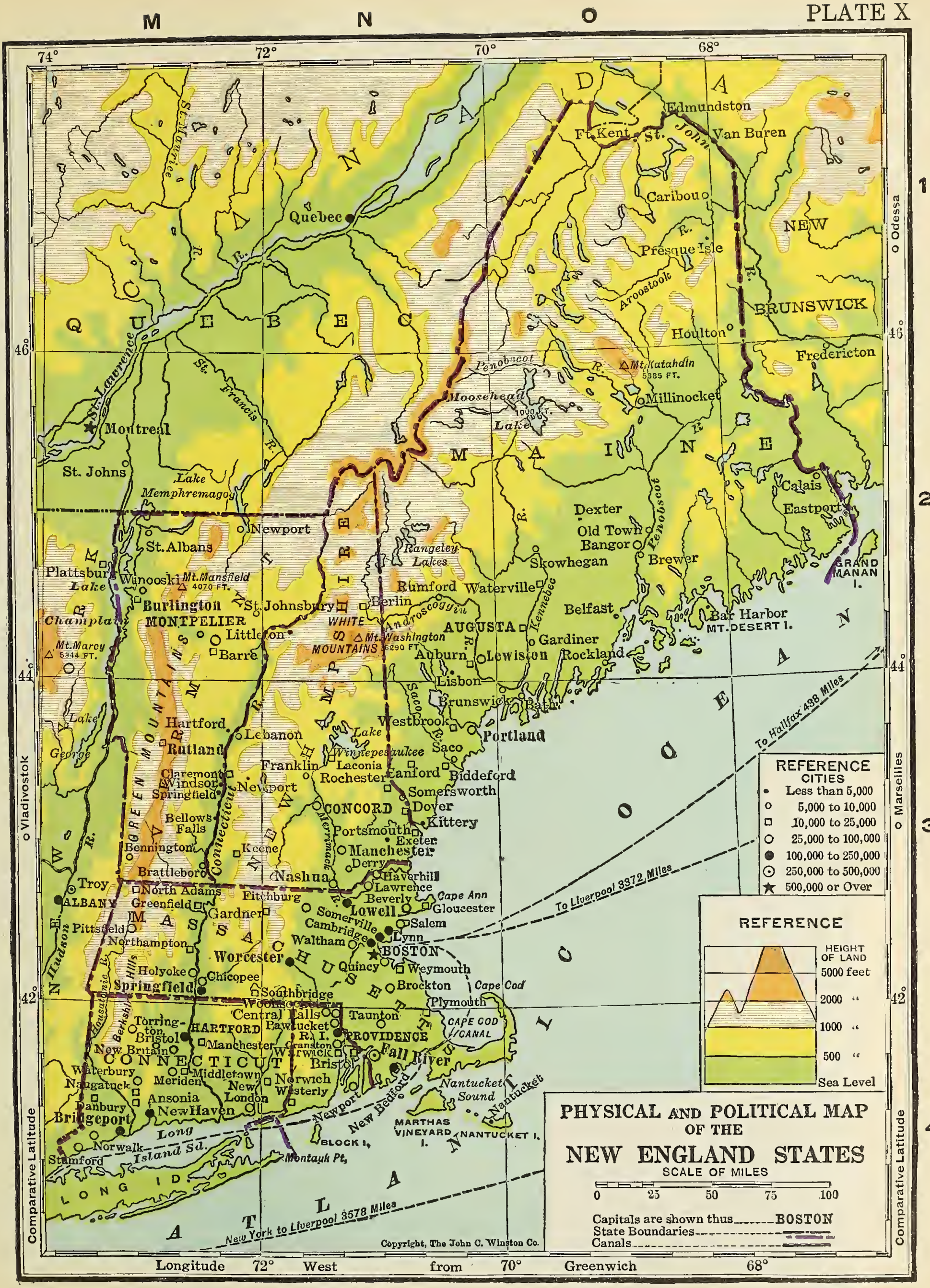

M
N
O
PHYSICAL AND POLITICAL MAP
OF THE
NEW ENGLAND STATES
SCALE OF MILES
0
25
50
75
100
Capitals are shown thus BOSTON
State Boundaries
Canals
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or Over
REFERENCE
HEIGHT OF LAND
5000 feet
2000 "
1000 "
500 "
Sea Level
Longitude 72° West from 70° Greenwich 68°
Comparative Latitude
Vladivostok
Odessa
Marseilles
CANADA
QUEBEC
NEW BRUNSWICK
MAINE
NEW HAMPSHIRE
VERMONT
MASSACHUSETTS
CONNECTICUT
R. I.
NEW YORK
ATLANTIC OCEAN
Quebec
Montreal
St. Johns
Edmundston
Ft. Kent
Van Buren
Caribou
Presque Isle
Houlton
Fredericton
Mt. Katahdin 5385 FT.
Millinocket
Moosehead Lake
Calais
Eastport
GRAND MANAN I.
Dexter
Old Town
Bangor
Brewer
Skowhegan
Waterville
Belfast
Bar Harbor
MT. DESERT I.
Rumford
AUGUSTA
Gardiner
Rockland
Auburn
Lewiston
Lisbon
Brunswick
Bath
Westbrook
Portland
Saco
Biddeford
Sanford
Rangeley Lakes
Berlin
WHITE MOUNTAINS
Mt. Washington 6290 FT.
Newport
St. Albans
Plattsburg
Winooski
Mt. Mansfield 4070 FT.
Burlington
MONTPELIER
St. Johnsbury
Littleton
Barre
Lake Champlain
Mt. Marcy 5344 FT.
Lake Memphremagog
Hartford
Lebanon
Rutland
Lake Winnepesaukee
Laconia
Franklin
Rochester
Somersworth
Dover
Claremont
Windsor
Springfield
Newport
CONCORD
Kittery
Portsmouth
Exeter
Bellows Falls
Bennington
Keene
Manchester
Derry
Nashua
Haverhill
Brattleboro
Troy
ALBANY
North Adams
Greenfield
Fitchburg
Lawrence
Beverly
Cape Ann
Gloucester
Lowell
Pittsfield
Gardner
Somerville
Salem
Northampton
Cambridge
Lynn
Waltham
BOSTON
Worcester
Quincy
Weymouth
Holyoke
Chicopee
Brockton
Cape Cod
Springfield
Southbridge
Plymouth
Woonsocket
Central Falls
Taunton
Torrington
Pawtucket
CAPE COD CANAL
HARTFORD
Bristol
Manchester
Cranston
PROVIDENCE
New Britain
Warwick
Bristol
Fall River
Waterbury
Naugatuck
Meriden
Middletown
Norwich
New London
Westerly
Newport
New Bedford
Nantucket Sound
Nantucket
Ansonia
Danbury
New Haven
Bridgeport
Norwalk
Stamford
Long Island Sd.
LONG ID.
BLOCK I.
Montauk Pt.
MARTHAS VINEYARD I.
NANTUCKET I.
To Halifax 438 Miles
To Liverpool 3372 Miles
New York to Liverpool 3578 Miles
Copyright, The John C. Winston Co.

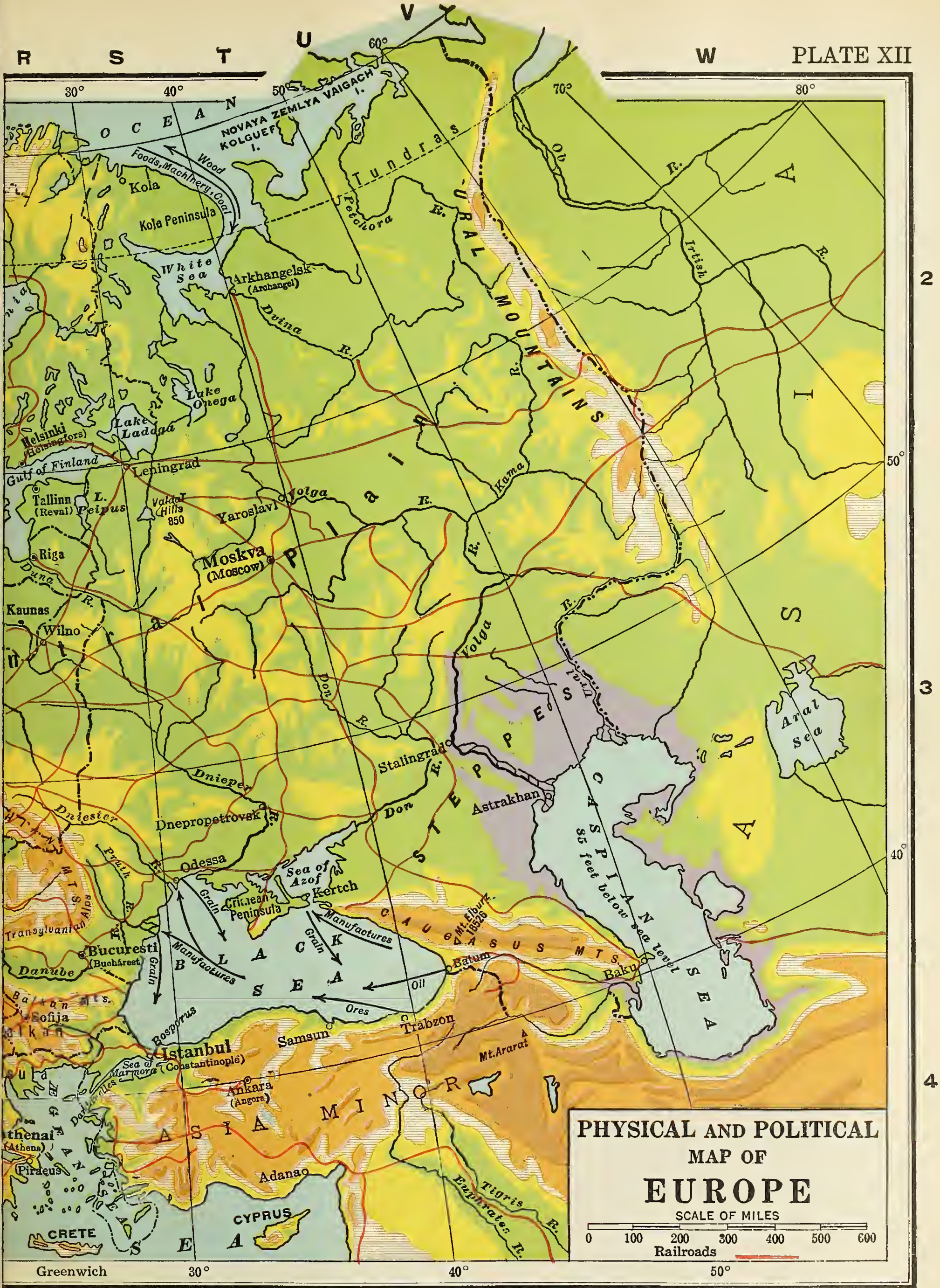
PLATE XI

PHYSICAL AND POLITICAL MAP
OF
SOUTH AMERICA
SCALE OF MILES
0 100 200 300 400 500 600 700 800
Railroads
CARIBBEAN SEA
ATLANTIC OCEAN
PACIFIC
EQUATOR
VENEZUELA
COLOMBIA
ECUADOR
PERU
BOLIVIA
BRAZIL
GUIANA
PANAMA
Caracas
Bogota
Quito
Lima
Manaos
Belém (Pará)
Pernambuco (Recife)
Bahia (Sao Salvador)
Georgetown
Paramaribo
Cayenne
Amazon
Orinoco
Magdalena
Madeira
Tocantins
Xingu
Sao Francisco
Brazilian Highlands
Guiana Highlands
Rubber, Brazil Nuts, United States, Europe
Food, Clothes, Gasoline and Supplies
Sugar, Rum, Balata Gum, Gold
Flour, Meat, Canned Food, U.S.
Textiles, Metal Goods, U.S., Europe
Cacao, Hides, Panama Hats, Ivory Nuts, U.S., Europe


REFERENCE
HEIGHT OF LAND
15000 feet
5000
2000
1000
500
Sea Level
Copyright, The John C. Winston Co.
Rio de Janeiro
Ouro Preto
Victoria
Santos
Sao Paulo
Curitiba
Blumenau
Florianopolis
Porto Alegre
Pelotas
Rio Grande do Sul
Montevideo
URUGUAY
Salto
Paysandu
Fray Bentos
Plata R.
Buenos Aires
La Plata
Bahia Blanca
Rosario
Sta. Fe
Cordoba
Rioja
Catamarca
Tucuman
Salta
Jujuy
Tarija
PARAGUAY
Asuncion
Villa Rica
Concepcion
V. del Pilar
Posadas
Corrientes
Resistencia
Iguassu Falls
Parana
Uruguay
Paraguay
Chaco
Mt. Potosi 15,381
El Potro Mt. 18,045
Mt. Aconcagua 22,812
San Juan
Mendoza
Colorado
Negro R.
Rawson
Puerto Deseado
Strait of Magellan
TIERRA DEL FUEGO
Cape Horn
Magallanes (Punta Arenas)
Port Stanley
FALKLAND IS. (Br.)
S. GEORGIA I. (Br.)
CHILOE I.
JUAN FERNANDEZ IS.
Iquique
Tocopilla
Atacama
Antofagasta
Caldera
Copiapo
Vallenar
Coquimbo
Valparaiso
Santiago
Constitucion
Chillan
Concepcion
Los Angeles
Temuco
Valdivia
Pto Montt
TROPIC OF CAPRICORN
Rice, Farther India
Flour, Argentina
Coffee, Manganese Ore, Medicines
Textiles, Machinery, Coal
Coffee, Meat
Meat, Wool, Wheat, Corn, Linseed, Hides, Skins, Tanning Extract, Mate
United States, Europe
Coal, Oil, Lumber, Iron
Textiles, Machinery, United States, Europe
Wheat, Meat, Wool
Wool, Skins, Tallow, Great Britain
Clothing, Coal, Supplies, Great Britain
Frozen Meat
Flour, Argentine
Wool, Meat, Skins, Europe
Clothing, Coal, Europe
Flour, Central Chile
Leather, Europe
Coal, Australia
Copper, Borax, U.S., Europe
Coal, Europe, Australia
Food, Cen. Chile
Food, Central Chile
Copper, Wool, Hides, Fruit, United States, Europe
Clothing, Machinery, Paper, Coal, United States, Europe
ATLANTIC OCEAN
PACIFIC OCEAN
CHILE
ARGENTINA
PATAGONIA
Longitude West from Greenwich
M N O P Q R
5 6 7
C
20 30 40 50
100° 90° 80° 70° 60° 50° 40° 30° 20°


M N O P Q
2
3
4
REFERENCE
HEIGHT OF LAND
6000 feet
3000
1200
600
Sea Level
Below Sea Level
ICELAND
Reykjavik
Wool, Fish
Wood, Coal, Manufactures
ARCTIC CIRCLE
FAROE IS.
SHETLAND IS.
ORKNEY IS.
HEBRIDES
BRITISH ISLES
IRELAND
GREAT BRITAIN
North Channel
Irish Sea
St. Georges Channel
Cape Clear
Mt. Snowden
London
Thames R.
English Chan.
Str. of Dover
Scandinavian Peninsula
Narvik
Iron Ore
Bergen
Oslo (Christiania)
Stockholm
L. Wenner
L. Wetter
Goteborg
GOTLAND
Skagerrack
Kattegat
Danish Peninsula
København (Copenhagen)
Iron Ore
Gulf of Bothnia
Foods
Fish
Coal, Textiles, Steel
Breadstuffs,
Woodpulp, Butter, Eggs, Bacon
Coffee, Coal, Cotton, Grain, Lumber
Rubber, Hides, Wood
Potash, Chemicals, Machinery,
Toys,
Coal, Steel,
Food
NORTH SEA
BALTIC SEA
Amsterdam
Rotterdam
Hamburg
Bremen
Berlin
Danzig
Warszawa (Warsaw)
Anvers
Havre
Paris
Ardennes
Black Forest
Germany
Praha (Prague)
BOHEMIA
CARPATHIAN
Wien (Vienna)
Danube
Budapest
Plains of Hungary
Food and raw materials from all parts of World
To United Kingdom
Manufactures to all parts of World
Coal, Tobacco, Cotton, Copper, Wool, Coffee, Rubber, Hides, Meat
Paris goods to U.S. and S.Am.
Chemicals, Raw Silks, Butter, Eggs, Fruit
Nitrate, Hides, Wool,
Metals, Coffee, Sugar, Cotton, Coal
Wines, Silks, Cottons
Brittany Peninsula
Loire R.
Seine R.
Dijon
Bordeaux
Central Highland
Cevennes
Rhone R.
Jura Mts.
L. Geneva
THE ALPS
Mt. Blanc 15782
Genova
Po R.
Trieste
Marseille
Bay of Biscay
Cape Finisterre
Iron Ore
Bilbao
Cantabrian Mts.
Olive Oil, Wine
Cork, Sardines, Hides, Wool
Codfish, Cocoa, Rice, Cotton, Coal, Rubber
Lisboa
Porto
Douro R.
Spanish Plateau
Madrid
Tagus R.
Guadiana R.
Iberian Peninsula
PYRENEES
Andorra
Ebro R.
Cape St. Vincent
Wine, Copper
Strait of Gibraltar
Cadiz
Sierra Nevada
Barcelona
Petroleum, Grain, Meat, Coal
Cotton, Wool, Machinery
Skins, Cork
BALEARIC IS.
MAJORCA
CORSICA
SARDINIA
Silk, Cotton Goods
Italian Peninsula
Roma (Rome)
Napoli
Vesuvius 4360
APENNINES
ADRIATIC SEA
Split
Dinaric Alps
Beograd (Belgrade)
Tirana
Brindisi
Strait of Otranto
Macaroni, Nuts,
Olive Oil
Coal, Meat, Petroleum, Machinery
Lemons, Sulphur
Petroleum, Meat, Coal, Machinery, Cotton, Grain
Str. of Messina
Palermo
Mt. Etna 10755
SICILY
IONIAN IS.
MALTA
MEDITERRANEAN
Alger
ATLAS MOUNTAINS
AFRICA
ATLANTIC OCEAN
Copyright, The John C. Winston Co.
10° Longitude West 0° Longitude 10° East from 20°

PLATE XII



R
S
T
U
V
W
2
3
4
30°
40°
50°
60°
70°
80°
50°
40°
OCEAN
NOVAYA ZEMLYA VAIGACH I.
KOLGUEF I.
Foods, Machinery, Coal
Wood
Kola
Kola Peninsula
White Sea
Arkhangelsk (Archangel)
Dvina R.
Tundras
Petchora R.
Ob R.
Irtish R.
URAL MOUNTAINS
Lake Onega
Lake Ladoga
Helsinki (Helsingfors)
Gulf of Finland
Leningrad
Tallinn (Reval)
L. Peipus
Valdai Hills 850
Yaroslavl
Volga
Moskva (Moscow)
Riga
Duna R.
Kaunas
Wilno
Kama
Volga
Ural
Don R.
STEPPES
Stalingrad
Astrakhan
Dnieper
Dniester
Dnepropetrovsk
Don
Pruth
Odessa
Grain
Sea of Azof
Crimean Peninsula
Kertch
Transylvanian Alps
Bucuresti (Bucharest)
Danube
BLACK SEA
Manufactures
Oil
Ores
Batum
CAUCASUS MTS.
Mt. Elburz 18526
Baku
CASPIAN SEA
85 feet below sea level
Aral Sea
ASIA
Sofija
Bosporus
Istanbul (Constantinople)
Sea of Marmora
Dardanelles
Samsun
Trabzon
Mt. Ararat
Ankara (Angora)
ASIA MINOR
AEGEAN SEA
Piraeus
CRETE
CYPRUS
Adana
Tigris R.
Euphrates R.
SEA
Greenwich
PHYSICAL AND POLITICAL MAP OF EUROPE
SCALE OF MILES
0 100 200 300 400 500 600
Railroads

Spellings of place names are in accord with the most recent decisions of the United States Geographic Board.

PLATE XIII

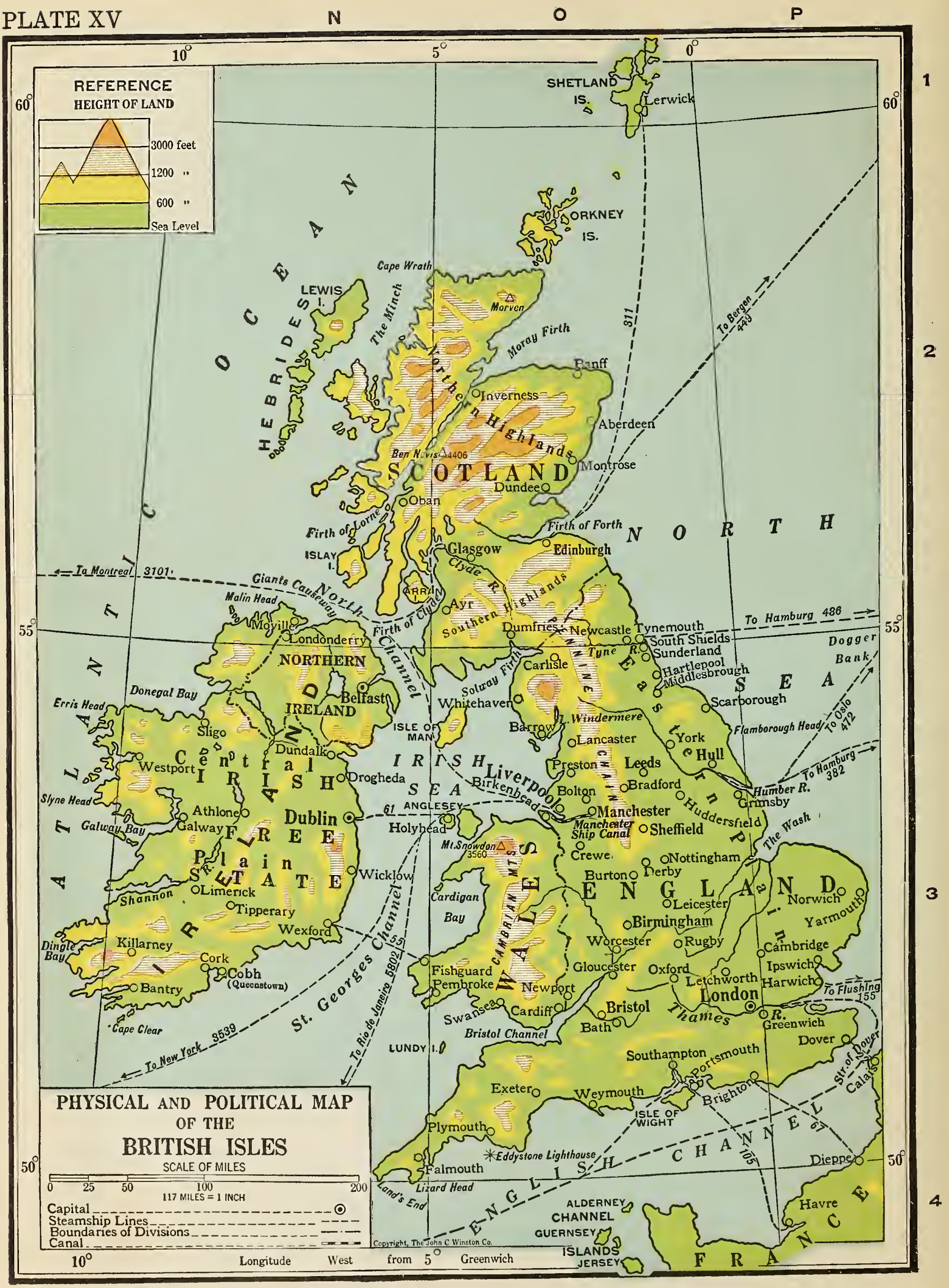

R
S
T
U
V
W
2
3
4
30°
40°
50°
60°
70°
80°
NOVAYA ZEMLYA
VAIGACH I.
KOLGUEF I.
O C E A N
North Cape
Vardo
Alexandrovsk
Murmansk
Kola
L A N D
White Sea
Mezen
Pechora
U R A L
M T S.
Obdorsk
Ob
R.
Irtis
S I B E R I A
Petropavlovsk
Tobolsk
Irbit
Sverdlovsk
(Ekaterinburg)
Chelyabinsk
Perm
Tornea
Uleaborg
Vaasa
Kuopio
Tampere
Viipuri
Helsinki
(Helsingfors)
Gulf of Finland
Kem
Onega
L. Onega
Arkhangelsk
(Archangel)
Dvina R.
Kotlas
Veliki Ustug
Vytegra
L. Ladoga
Kronstadt
Leningrad
(Petrograd)
Vologda
Viatka
Kama
Ufa
Magnitogorsk
Tallinn
(Reval)
ESTONIA
Dorpat
Gulf of Riga
Riga
LATVIA
Mitau
Dvinsk
UNION OF SOCIALIST SOVIET REPUBLICS
R U S S I A
Kostroma
Yaroslav
Volga
Gorki
(Nizhni Novgorod)
Kazan
Tver
Moskva
(Moscow)
Samara
Orenburg
LITHUANIA
Kaunas
(Kovno)
Wilno
WHITE RUSSIA
Duna
Vitebsk
Smolensk
Minsk
Mohilef
Grodno
Bialystok
Brest-Litovsk
Riazan
Penza
Kusnetsk
Tambof
Kaluga
Tula
Orel
Kursk
Voronezh
Saratof
Ural
Dnieper
Don
POLAND
Lublin
Przemysl
Shitomir
Sumy
Kharkov
Berdichef
Kiev
Poltava
U K R A I N E
Stalingrad
Lwow
(Lemberg)
Kremenchug
Kamenets Podolsk
Zinoviev
Dnepropetrovsk
Novocherkask
Astrakhan
Taganrog
Rostov
Nikolayef
Cernowitz
Kishenef
Oradia Mare
Cluj
Jassy
R U M A N I A
Kherson
Sea of Azov
Odessa
Ekaterinodar
Galatz
Ploesti
Braila
Bucuresti
(Bucharest)
Simferopol
Sevastopol
Kertch
Novorossiisk
CAUCASUS MTS.
ABCHASIA
Vladikavkas
Kutais
GEORGIA
Tiflis
Poti
Batum
AZERBAIJAN
Baku
Alexandropol
ARMENIA
Erivan
NAKCHACHEVAN
Danube
Rustchuk
Plevna
Varna
BALKAN MTS.
Sofiya
Sliven
BULGARIA
Philippopolis
BLACK SEA
Edirne
Istanbul
(Constantinople)
Bosporus
Uskudar
Trabzon
Erzurum
Mt. Ararat
L. Van
L. Urmia
Thessalonike
Sea of Marmora
Dardanelles
Bursa
Ankara
(Angora)
Sivas
Mush
Van
Bitlis
T U R K E Y
Volos
Athenai
(Athens)
Corinth Canal
Piraeus
Izmir
(Smyrna)
Kayseri
A S I A   M I N O R
Diarbekr
Tigris
Euphrates
Konya
Maras
Alexandretta
SYRIA
I R A Q
(MESOPOTAMIA)
AEGEAN SEA
GREECE
RHODES
(It. Adm.)
CRETE
CYPRUS
(Br.)
CASPIAN SEA
ARAL SEA
Krasnovodsk
from
Greenwich
POLITICAL MAP
OF
EUROPE
SCALE OF MILES
0
100
200
300
400
500

PLATE XIV

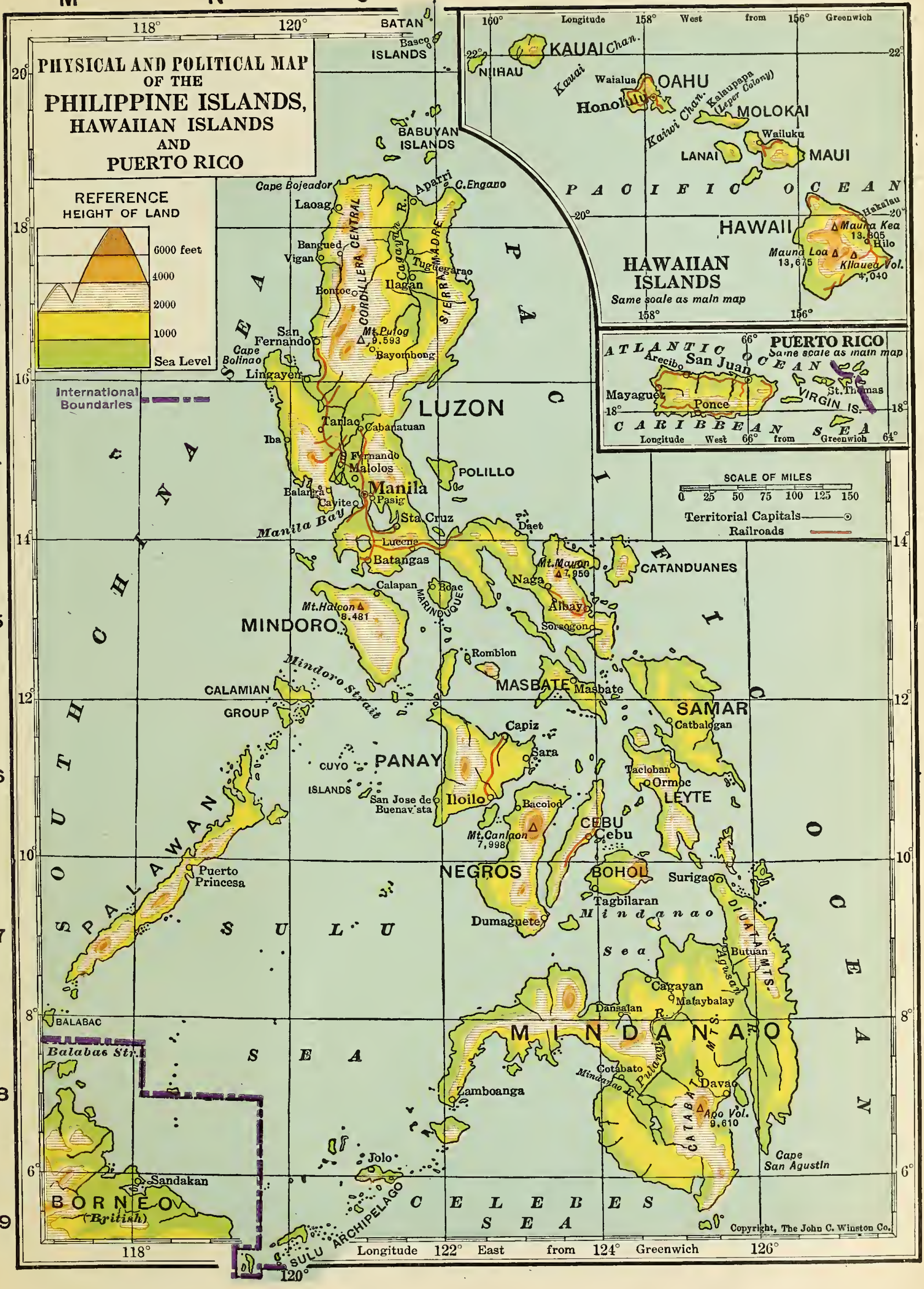
N
O
P
Q
R
2
3
4
5
6
7
ATLANTIC OCEAN
English Channel
Bay of Biscay
FRANCE
SPAIN
PORTUGAL
GERMANY
AUSTRIA
ITALY
SWITZERLAND
BELGIUM
LUXEMBOURG
MONACO
ANDORRA
MOROCCO (To France)
SPANISH MOROCCO
ALGERIA (To France)
TUNISIA
TYRRHENIAN SEA
MEDITERRANEAN SEA
CORSICA
SARDINIA (To Italy)
SICILY
BALEARIC IS.
MAJORCA
MENORCA
MALTA (Br.)
PANTELLERIA (To Italy)
LAMPEDUSA (To Italy)
JERBA I.
Strait of Gibraltar
Strait of Bonifacio
Gulf of the Lion
Gulf of Genoa
Gulf of Valencia
Gulf of Gabes
Tangier (Neutral Zone)
Gibraltar (Br.)
CHANNEL IS. (Br.)
Paris
Madrid
Lisboa (Lisbon)
Roma (Rome)
Marseille
Barcelona
Bordeaux
Lyon
Milano (Milan)
Torino (Turin)
Genova (Genoa)
Napoli (Naples)
Firenze (Florence)
Venezia (Venice)
Tunis
Tripoli
Alger (Algiers)
Oran
Casablanca
Rabat
Tetuan
Melilla
Coal, Tobacco, Cotton, Copper, Wool, Coffee, Rubber, Hides, Meat
Paris goods to U.S. and S.Am.
Chemicals, Raw Silks, Butter, Eggs, Fruit
Wines, Silks, Cotton
Nitrate, Hides, Wool, Metals, Coffee, Sugar, Cotton, Coal
Iron Ore
Olive Oil, Wine
Cork, Sardines, Hides, Wool
Codfish, Rice, Cocoa, Cotton, Coal, Rubber
Wine, Copper
Fruits and Vegetables
Skins, Cork
Petroleum, Grain, Meat, Coal, Cotton, Wool, Machinery
Silk Goods
Cotton Goods
Macaroni, Nuts, Olive Oil
Coal, Meat, Petroleum, Machinery
Lemons, Sulphur
Petroleum, Meat, Coal, Machinery, Cotton, Grain
PALESTINE
SCALE OF MILES
0 10 20 30 40 50
SYRIA
LEBANON
TRANS-JORDAN
Damas (Damascus)
Jerusalem
Bethlehem
Jaffa
Haifa
Gaza
Hebron
Sea of Galilee
Dead Sea 1292 feet below sea level
Jordan R.
REFERENCE
HEIGHT OF LAND
12,000 feet
6000
3000
1200
600
Sea Level
Below Sea Level
Longitude West
Longitude East

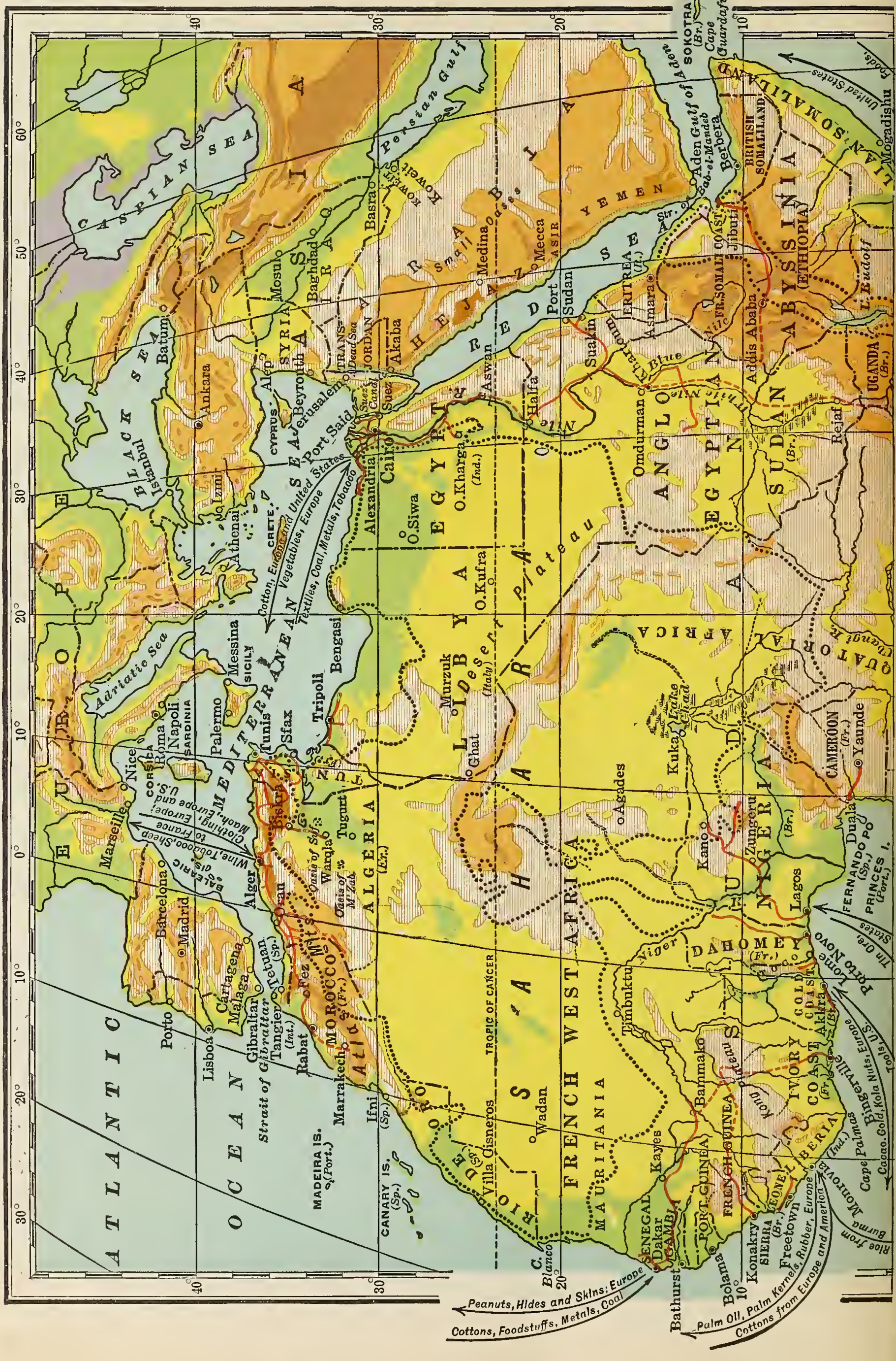
PHYSICAL AND POLITICAL MAP OF
MEDITERRANEAN LANDS
SCALE OF MILES
0 100 200 300 400 500
Shott, a salt Lake, often dry
Railroads
S T U V W
2 3 4 5 6 7
15° 20° 25° 30° 35° 40° 45°
15° from 20° Greenwich 25° 30° 35°
45° 40° 35° 30° 25°
POLAND
UNION OF SOVIET SOCIALIST REPUBLICS
UKRAINE
CZECHOSLOVAKIA
HUNGARY
RUMANIA
YUGOSLAVIA
BULGARIA
ALBANIA
GREECE
TURKEY
ANATOLIA (ASIA MINOR)
SYRIA (French Mandate)
TRANS-JORDAN
PALESTINE
LEBANON
CYPRUS (British)
CRETE (To Greece)
DODECANESE ISLANDS (To Italy)
LIBYA (To Italy)
CYRENAICA
EGYPT
Sinai Peninsula
Mt. Sinai 8593
Arabian Desert
BLACK SEA
Sea of Azov
Sea of Marmara
AEGEAN SEA
IONIAN SEA
ADRIATIC SEA
MEDITERRANEAN SEA
RED SEA
Gulf of Sidra
Gulf of Suez
Gulf of Aqaba
Gulf of Antalya
Gulf of Alexandretta
Gulf of Taranto
Strait of Otranto
Strait of Messina
Dead Sea 1292 feet below sea level
Sea of Galilee
Suez Canal
Nile Delta
First Cataract
Pyramids
Birket el Qurum
Oasis of Siwa
Wahat el Dakhla (Oasis)
CARPATHIAN MTS.
TRANSYLVANIAN ALPS
DINARIC ALPS
BALKAN MTS.
TAURUS MTS.
Mt. Olympus 9790
Iron Gate
Danube
Dnepr R.
Dniester R.
Bug R.
Pruth R.
Don R.
Kuban R.
Drava R.
Sava R.
Tisza R.
Morava R.
Maritza R.
Vardar R.
Kizil R.
Sakaria R.
Euphrates R.
Nile R.
Grain
Manufactures
Oil
Ores
Figs
Currants, Tobacco, Olive Oil
Cotton, Vegetables
Lodz
Lublin
Breslau
Krakow
Lwow
Zhitomir
Berdichev
Ostrava Moravska
Brno (Brünn)
Kosice
Mukacevo
Bratislava
Wien
Budapest
Debrecen
Graz
Szeged
Subotica
Zagreb
Banjaluka
Beograd (Belgrade)
Sarajevo
Mostar
Split
Zara
Nis
Kotor
Shkodër (Scutari)
Durrës (Durazzo)
Tirana
Vlorë (Volona)
Korçë
Bitolj
Skoplje
Sofiya (Sofia)
Plovdiv
Pleven
Ruse (Ruschuk)
Varna
Burgas
Edirne (Adrianople)
Kavalla
Thessalonike
Larisa
Volos
Ioannina (Yannina)
Kerkyra CORFU I.
Patrai
Corinth
Kalamai
Athenai (Athens)
Peiraiev (Piraeus)
KYTHERA
Khania (Canea)
Erakleion (Candia)
Rodi RODI I.
THASOS
IMROZ
LEMNOS I.
MITYLENE
KHIOS
SAMOS
Cernauti
Iasi
Chisinau
Cluj
Oradea
Arad
Timisoara
Brasov
Galati
Braila
Ismail
Ploesti
Bucuresti
Craiova
Constanta
Odessa
Kherson
Vernoleninsk
Zinovievsk
Dnepropetrovsk
Taganrog
Rostov
Novocherkassk
Berdyansk
Kerch
Feodosiya
Crimean Pen.
Simferopol
Sevastopol
Yalta
Krasnodar
Novorssiisk
Stavropol
Batum
Trabzon
Sinop
Inebolu
Kastamonu
Amasya
Erzincan
Erzurum
Sivas
Harput
Malatya
Kayseri
Maras
Urfa
Istanbul (Constantinople)
Bosporus
Uskudar (Scutari)
Eregli
Bursa
Eskisehir
Ankara (Angora)
Tuzla Lake
Konya
Afyon Karahisar
Manissa
Izmir (Smyrna)
Aydin
Antalya (Adalia)
Adana
Tarsus
Mersin
Gaziantep (Aintab)
Alexandretta
Alep (Aleppo)
Antioche
Lattaquie
Hama
Homs
Tripoli
Beyrouth (Beirut)
Damas (Damascus)
Larnaka
Haifa
Jaffa
Jerusalem
Gaza
Aqaba
Port Said
Dumiat (Damietta)
Alexandria
Tanta
Giza
Cairo
Suez
Fayum
Beni Suef
Asyut
Qena
Luqsor
Isna
Aswan
Sallum
Derna
Bengasi
Misurata
Sirte
Muctar (El Mugtaa)
Bari
Brindisi
Taranto
Messina
Reggio
Catania
Siracusa (Syracuse)
STROMBOLI I.
IONIAN IS.

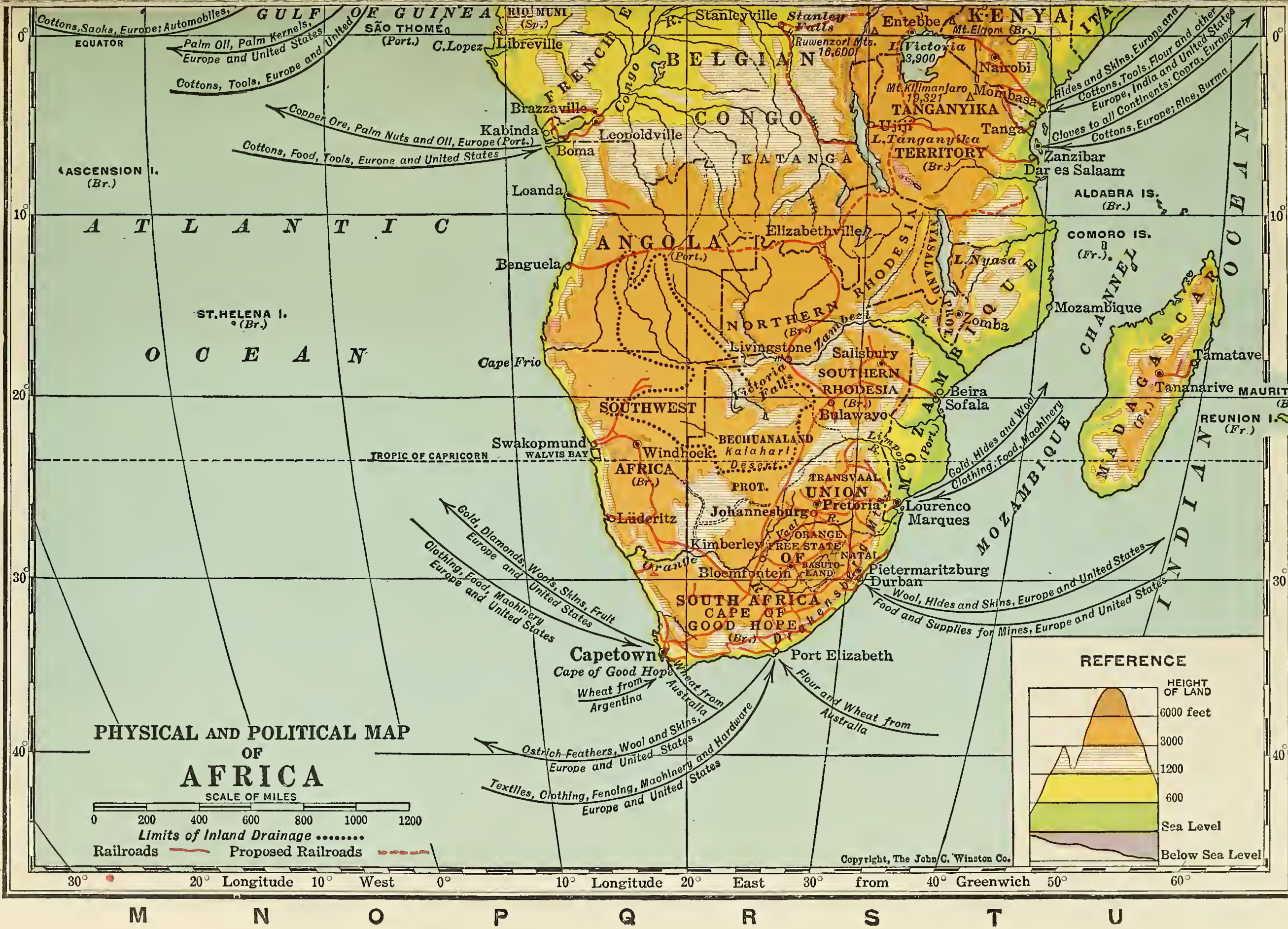
PLATE XV



PHYSICAL AND POLITICAL MAP OF THE BRITISH ISLES
SCALE OF MILES
0 25 50 100 200
117 MILES = 1 INCH
Capital
Steamship Lines
Boundaries of Divisions
Canal
REFERENCE
HEIGHT OF LAND
3000 feet
1200 "
600 "
Sea Level
N
O
P
1
2
3
4
10°
5°
0°
60°
55°
50°
Longitude West from 5° Greenwich
SHETLAND IS.
Lerwick
ORKNEY IS.
Cape Wrath
Morven
LEWIS I.
The Minch
Moray Firth
Banff
Inverness
Aberdeen
Northern Highlands
Ben Nevis 4406
SCOTLAND
Montrose
Dundee
Oban
Firth of Lorne
Firth of Forth
Edinburgh
Glasgow
Clyde R.
ISLAY I.
ARRAN
Ayr
Southern Highlands
Firth of Clyde
Dumfries
Newcastle
Tynemouth
South Shields
Sunderland
Tyne R.
Carlisle
Hartlepool
Middlesbrough
Solway Firth
Whitehaven
Scarborough
L. Windermere
Barrow
Lancaster
York
Hull
Flamborough Head
Preston
Leeds
Bradford
Liverpool
Birkenhead
Bolton
Manchester
Manchester Ship Canal
Sheffield
Huddersfield
Humber R.
Grimsby
The Wash
Crewe
Nottingham
Burton
Derby
Leicester
Norwich
Yarmouth
Birmingham
Worcester
Rugby
Cambridge
Gloucester
Oxford
Letchworth
Ipswich
Harwich
London
Thames R.
Greenwich
Bristol
Bath
Dover
Southampton
Portsmouth
Brighton
Weymouth
ISLE OF WIGHT
Exeter
Plymouth
Eddystone Lighthouse
Falmouth
Lizard Head
Land's End
ENGLAND
East Pennine Chain
Pennine Chain
WALES
CAMBRIAN MTS.
Mt. Snowdon 3560
ANGLESEY
Holyhead
Cardigan Bay
Fishguard
Pembroke
Swansea
Cardiff
Newport
Bristol Channel
LUNDY I.
ISLE OF MAN
IRISH SEA
NORTH SEA
Dogger Bank
ENGLISH CHANNEL
Str. of Dover
Calais
Dieppe
Havre
FRANCE
ALDERNEY
GUERNSEY
CHANNEL ISLANDS
JERSEY
ATLANTIC OCEAN
HEBRIDES
Giants Causeway
North Channel
Malin Head
Moville
Londonderry
NORTHERN IRELAND
Belfast
Donegal Bay
Erris Head
Sligo
Dundalk
Westport
Central Irish Plain
Drogheda
Slyne Head
Athlone
Galway
Galway Bay
Dublin
IRISH FREE STATE
Wicklow
Shannon
Limerick
Tipperary
Wexford
Dingle Bay
Killarney
Cork
Cobh (Queenstown)
Bantry
Cape Clear
St. Georges Channel
To Montreal 3101
To New York 3539
To Rio de Janeiro 5802
To Bergen 449
To Hamburg 486
To Oslo 472
To Hamburg 382
To Flushing 155
311
61
55
105
67
Copyright, The John C Winston Co.


PHYSICAL AND POLITICAL MAP OF THE PHILIPPINE ISLANDS, HAWAIIAN ISLANDS AND PUERTO RICO
REFERENCE
HEIGHT OF LAND
6000 feet
4000
2000
1000
Sea Level
International Boundaries
LUZON
MINDORO
PANAY
NEGROS
CEBU
BOHOL
SAMAR
LEYTE
MINDANAO
PALAWAN
BORNEO (British)
SOUTH CHINA SEA
SULU SEA
CELEBES SEA
PACIFIC OCEAN
Manila
HAWAIIAN ISLANDS
Same scale as main map
PUERTO RICO
Same scale as main map
SCALE OF MILES
0 25 50 75 100 125 150
Territorial Capitals
Railroads
Copyright, The John C. Winston Co.


M N O P Q R S T U
2
3
4
5
EUROPE
ATLANTIC OCEAN
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
Adriatic Sea
RED SEA
Persian Gulf
Gulf of Aden
ASIA
ARABIA
AFRICA
SAHARA
Libyan Desert
Plateau
TROPIC OF CANCER
MOROCCO (Fr.)
ALGERIA (Fr.)
LIBYA (Italy)
EGYPT
ANGLO EGYPTIAN SUDAN
ABYSSINIA (ETHIOPIA)
FRENCH WEST AFRICA
MAURITANIA
RIO DE ORO (Sp.)
NIGERIA (Br.)
DAHOMEY (Fr.)
GOLD COAST (Br.)
IVORY COAST (Fr.)
LIBERIA
SIERRA LEONE (Br.)
FRENCH GUINEA
PORT. GUINEA
GAMBIA
SENEGAL
CAMEROON (Fr.)
UGANDA (Br.)
ITALIAN SOMALILAND
BRITISH SOMALILAND
FR. SOMALI COAST
ERITREA (It.)
YEMEN
HEJAZ
ASIR
SYRIA
TRANS-JORDAN
CYPRUS
CRETE
SICILY
SARDINIA
CORSICA
BALEARIC IS.
MADEIRA IS. (Port.)
CANARY IS. (Sp.)
SOKOTRA I. (Br.)
FERNANDO PO (Sp.)
PRINCES I. (Port.)
Strait of Gibraltar
Atlas Mts.
Nile
Blue Nile
White Nile
Niger
Lake Chad
L. Rudolf
Cape Guardafui
Bab-el-Mandeb
C. Blanco
Cape Palmas
Lisboa
Porto
Madrid
Barcelona
Cartagena
Malaga
Gibraltar
Tangier (Int.)
Tetuan (Sp.)
Rabat
Fez
Marrakech
Ifni (Sp.)
Oran
Alger
Tunis
Sfax
Tripoli
Bengasi
Marseille
Nice
Roma
Napoli
Palermo
Messina
Athenai
Istanbul
Izmir
Ankara
Batum
Aleppo
Beyrouth
Jerusalem
Port Said
Suez Canal
Suez
Alexandria
Cairo
Akaba
Dead Sea
Mosul
Baghdad
Basra
Koweit
Medina
Mecca
Port Sudan
Suakin
Asmara
Aden
Jibuti
Berbera
Mogadishu
Addis Ababa
Khartoum
Omdurman
Halfa
Aswan
O. Kharga
O. Siwa
O. Kufra
Murzuk
Ghat
Agades
Kuka
Kano
Zungeru
Lagos
Porto Novo
Lome
Akkra
Bingerville
Monrovia
Freetown
Konakry
Bolama
Bathurst
Dakar
Kayes
Bammako
Timbuktu
Wadan
Villa Cisneros
Warqla
Tugurt
Biskra
Oasis of M'Zab
Yaunde
Duala
Rejaf
Cotton, Europe and United States
Vegetables, Europe
Textiles, Coal, Metals, Tobacco
Wine, Tobacco, Sheep to France
Clothing, Europe and U.S.
Mach., Europe
Peanuts, Hides and Skins; Europe
Cottons, Foodstuffs, Metals, Coal
Palm Oil, Palm Kernels, Rubber, Europe
Cottons from Europe and America
Rice from Burma
Cacao, Gold, Kola Nuts, Europe
Tools, U.S.
Tin ore, States
Goods, United States


PHYSICAL AND POLITICAL MAP
OF
AFRICA
SCALE OF MILES
0 200 400 600 800 1000 1200
Limits of Inland Drainage
Railroads
Proposed Railroads
REFERENCE
HEIGHT OF LAND
6000 feet
3000
1200
600
Sea Level
Below Sea Level
Copyright, The John C. Winston Co.
30° 20° Longitude 10° West 0° 10° Longitude 20° East 30° from 40° Greenwich 50° 60°
M N O P Q R S T U
6 7 8 9
EQUATOR
TROPIC OF CAPRICORN
GULF OF GUINEA
ATLANTIC OCEAN
INDIAN OCEAN
MOZAMBIQUE CHANNEL
ASCENSION I. (Br.)
ST. HELENA I. (Br.)
SÃO THOMÉ (Port.)
RIO MUNI (Sp.)
ALDABRA IS. (Br.)
COMORO IS. (Fr.)
MAURITIUS I. (Br.)
REUNION I. (Fr.)
MADAGASCAR (Fr.)
FRENCH
BELGIAN CONGO
KATANGA
KENYA
TANGANYIKA TERRITORY (Br.)
ANGOLA (Port.)
NORTHERN RHODESIA (Br.)
SOUTHERN RHODESIA (Br.)
NYASALAND PROT.
MOZAMBIQUE (Port.)
SOUTHWEST AFRICA (Br.)
BECHUANALAND PROT.
Kalahari Desert
UNION OF SOUTH AFRICA
TRANSVAAL
ORANGE FREE STATE
NATAL
BASUTOLAND
CAPE OF GOOD HOPE (Br.)
Libreville
C. Lopez
Stanleyville
Stanley Falls
Ruwenzori Mts. 16,600
Entebbe
Mt. Elgon
L. Victoria 3,900
Nairobi
Mt. Kilimanjaro 19,321
Mombasa
Tanga
Ujiji
L. Tanganyika
Zanzibar
Dar es Salaam
Brazzaville
Kabinda
Leopoldville
Boma
Congo R.
Loanda
Benguela
Elizabethville
L. Nyasa
Zomba
Mozambique
Livingstone
Zambezi R.
Victoria Falls
Salisbury
Beira
Sofala
Bulawayo
Limpopo R.
Cape Frio
Swakopmund
WALVIS BAY
Windhoek
Lüderitz
Johannesburg
Pretoria
Vaal R.
Kimberley
Bloemfontein
Orange R.
Lourenco Marques
Pietermaritzburg
Durban
Drakensberg
Capetown
Cape of Good Hope
Port Elizabeth
Tamatave
Tananarive
Cottons, Sacks, Europe; Automobiles, United States
Palm Oil, Palm Kernels, Europe and United States
Cottons, Tools, Europe and United States
Copper Ore, Palm Nuts and Oil, Europe
Cottons, Food, Tools, Europe and United States
Hides and Skins, Europe and United States
Cottons, Tools, Flour and other Europe, India and United States
Cloves to all Continents; Copra, Europe
Cottons, Europe; Rice, Burma
Gold, Hides and Wool
Clothing, Food, Machinery
Gold, Diamonds, Wools, Skins, Fruit Europe and United States
Clothing, Food, Machinery Europe and United States
Wool, Hides and Skins, Europe and United States
Food and Supplies for Mines, Europe and United States
Wheat from Argentina
Wheat from Australia
Flour and Wheat from Australia
Ostrich-Feathers, Wool and Skins, Europe and United States
Textiles, Clothing, Fencing, Machinery and Hardware Europe and United States


M
N
O
P
Q
R
2
3
4
5
6
30°
40°
50°
60°
70°
80°
90°
BLACK SEA
Sea of Azov
Don R.
Volga
R.
Orenburg
Ural
KIRGHIZ
CASPIAN SEA
SIBERIA
Omsk
Irtish
Barnaul
Semipalatinsk
ALTAI
Aral Lake
TURKESTAN
Lake Balkhash
Ili
Kulja
TIAN SHAN
Trabzon
Batum
GEORGIA
Tiflis
AZER.
BAIJAN
ARMENIA
Erivan
TURKEY
Baku
SYRIA
Mosul
Tabriz
Resht
Khiva
Amu
Kizil Kum
Tashkent
Euphrates
Tigris
Hamadan
ELBURZ MTS.
Demavend 18,600
Barfrush
Kara Kum
Bukhara
Syrian Desert
Baghdad
MESOPOTAMIA
Tehran
Meshed
Merv
Darya
Samarkand
Kermanshah
Great Salt Desert
Shufu (Kashgar)
SINKIANG
Tarim R.
Tarim Basin
Yarkand
Takla Makan
Hotien (Khotan)
ALTYN TAGH
Basra
Isfahan
PERSIA
Yezd
Herat
AFGHANISTAN
HINDU KUSH
KARAKORAM MTS.
KASHMIR
Koweit
Kuh-i-Dena 17,000
Kabul
Peshawar
Srinagar
ARABIA
Shiraz
Kerman
PERSIAN GULF
Iran
Amritsar
Lahore
Multan
Simla
Kalat
BALUCHISTAN
TIBET
HIMALAYA
Shikarpur
Meerut
Delhi
Bareilly
Dhaulagiri 26,826
Sanpo
Mt. Everest 29,141
Indus
Gulf of Oman
OMAN
Muscat
Karachi
Hyderabad
Thar or Indian Desert
Lowlands
Ajmer
Jodhpur
Agra
Cawnpore
Lucknow
Katmandu
NEPAL
Darjeeling
Ganges
Jhansi
Allahabad
Benares
Patna
Indo-Gangetic
INDIA
Bhopal
Ahmadabad
Baroda
Jubbulpore
Narbada
HADRAMAUT
Wheat, Europe
ARABIAN SEA
Surat
Calcutta
Nagpur
Cuttack
Bombay
Poona
Godavari
Puri
SOCOTRA I. (Br.)
Cotton Goods, Machinery, Metal Ware, Europe
Kerosene, Machinery, United States
Western Ghats
Hyderabad
Kistna
R.
Goa (Port.)
Yanaon (Fr.)
BAY OF BENGAL
Sugar, Java
Cotton Cloth, China, Japan
Raw Cotton, Oil Seeds, Europe; Japan
Hides and Skins, U.S.
Bellary
Hubli
Madras
Hides, Skins, U.S.
Cotton, Japan
Bangalore
Mysore
Eastern Ghats
Pondichery Fr.
Calicut
Trichinopoly
Machinery, Metal Ware, Europe
Machinery, U.S.
Hides, Skins, U.S.; Tea, Europe
Jute, N.A., Europe; Burlap, All Cont.
Madura
Palk Str.
C. Comorin
Rubber, Copra
CEYLON
Kandy
Colombo
Cotton Goods
Kerosene, Machinery
INDIAN OCEAN
REFERENCE
HEIGHT OF LAND
12000 feet
6000
3000
1500
600
Sea Level
Below Sea Level
60°
70°
80°
Longitude
East
90°

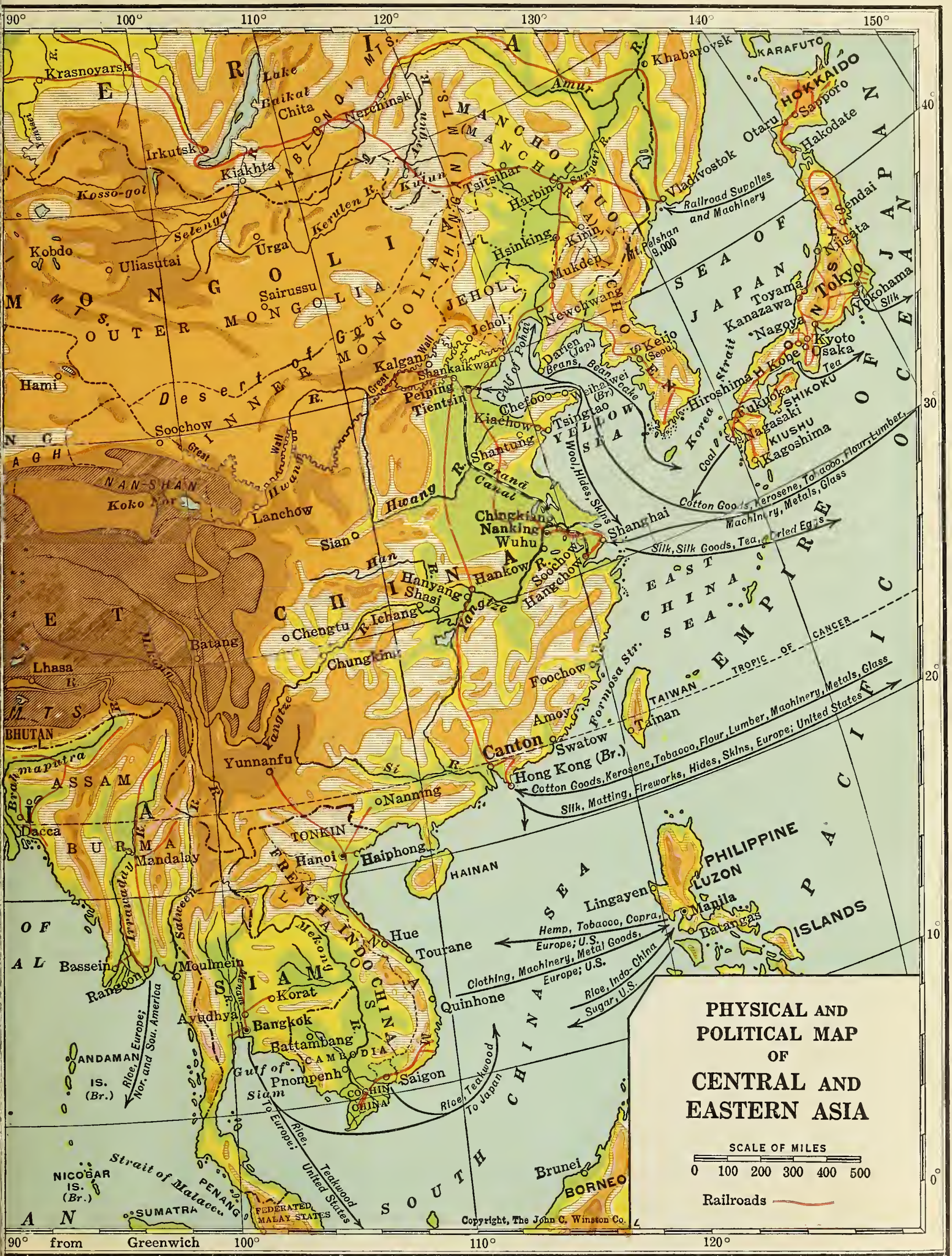
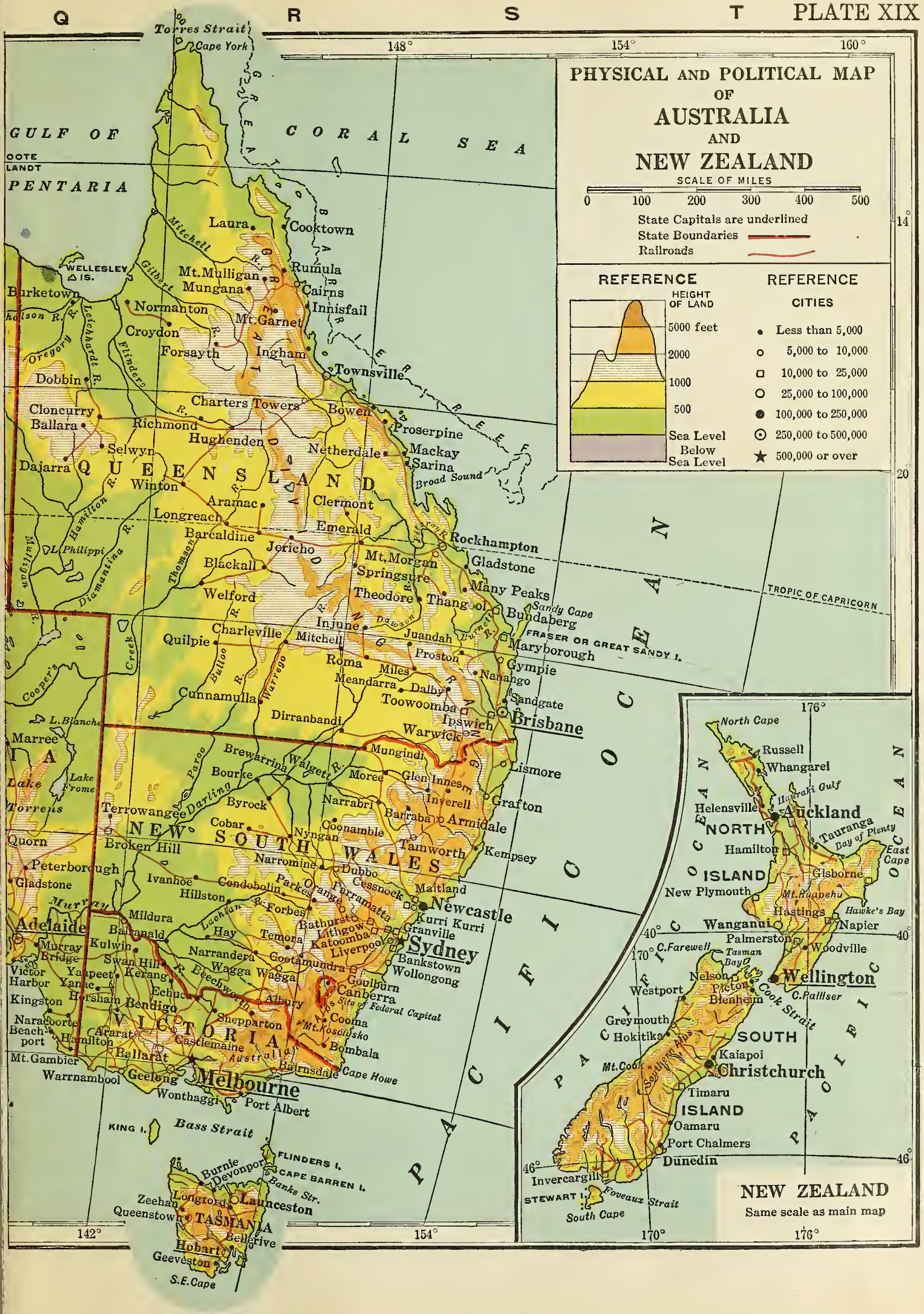
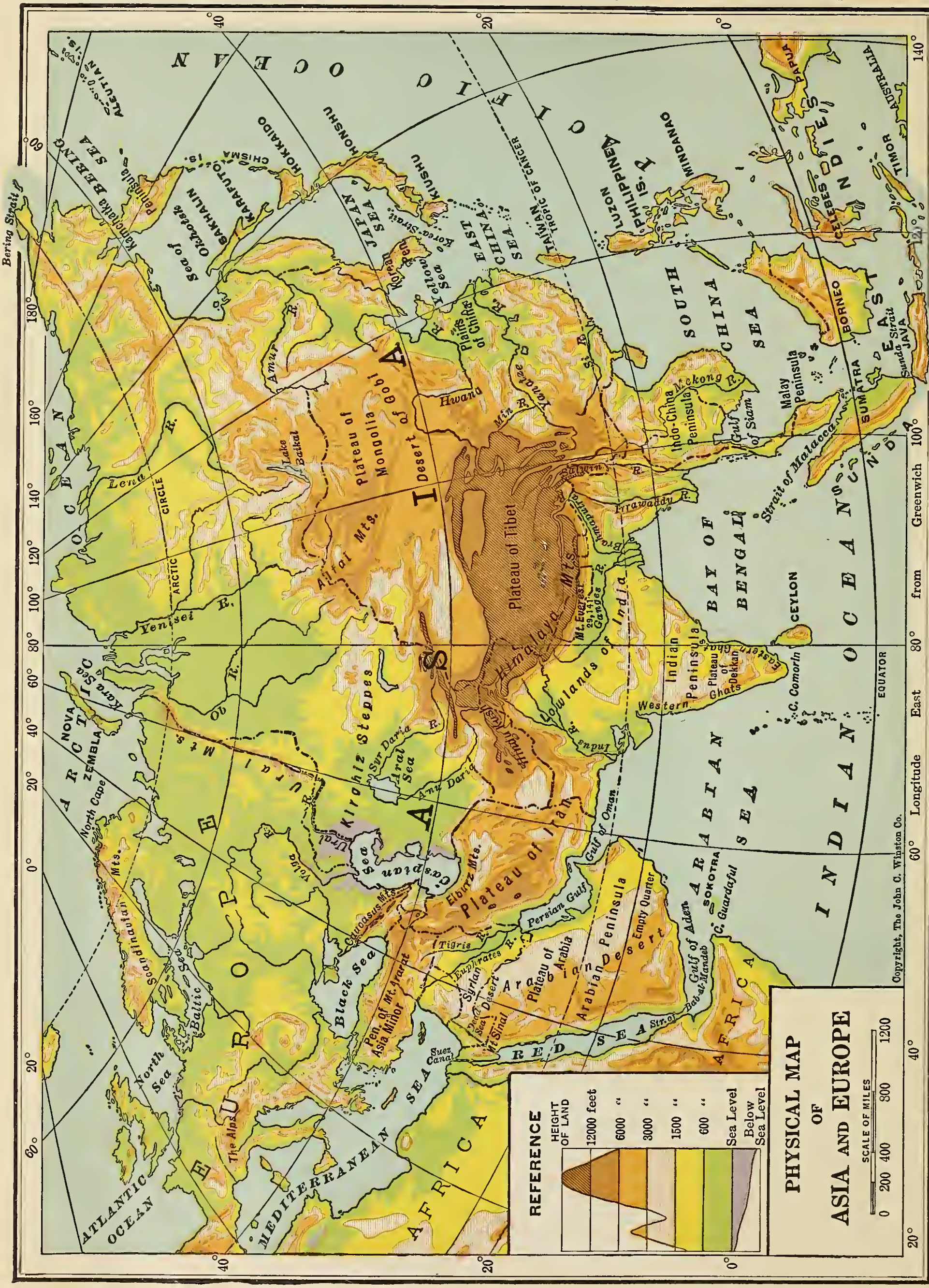

PHYSICAL AND POLITICAL MAP OF CENTRAL AND EASTERN ASIA
SCALE OF MILES
0 100 200 300 400 500
Railroads
Copyright, The John C. Winston Co.
90° from Greenwich 100° 110° 120°
90° 100° 110° 120° 130° 140° 150°
SIBERIA
MONGOLIA
OUTER MONGOLIA
INNER MONGOLIA
Desert of Gobi
MANCHOUKUO
CHOSEN
JEHOL
CHINA
TIBET
SIAM
FRENCH INDO CHINA
BURMA
INDIA
ASSAM
BHUTAN
JAPAN
EMPIRE
PACIFIC OCEAN
SEA OF JAPAN
YELLOW SEA
EAST CHINA SEA
SOUTH CHINA SEA
HOKKAIDO
HONSHU
SHIKOKU
KIUSHU
KARAFUTO
TAIWAN
HAINAN
PHILIPPINE ISLANDS
LUZON
BORNEO
SUMATRA
ANDAMAN IS. (Br.)
NICOBAR IS. (Br.)
FEDERATED MALAY STATES
PENANG
TONKIN
CAMBODIA
COCHIN CHINA
Strait of Malacca
Gulf of Siam
Gulf of Pohai
Formosa Str.
Korea Strait
TROPIC OF CANCER
Krasnoyarsk
Irkutsk
Kiakhta
Chita
Nerchinsk
Khabarovsk
Vladivostok
Urga
Uliasutai
Kobdo
Sairussu
Hami
Kalgan
Peiping
Tientsin
Shankaikwan
Jehol
Tsitsihar
Harbin
Hsinking
Kirin
Mukden
Newchwang
Dairen (Jap.)
Weihaiwei (Br.)
Chefoo
Tsingtao
Kiaochow
Keijo (Seoul)
Mt. Paishan 9,000
Sapporo
Otaru
Hakodate
Sendai
Niigata
Tokyo
Yokohama
Toyama
Kanazawa
Nagoya
Kyoto
Osaka
Kobe
Hiroshima
Fukuoka
Nagasaki
Kagoshima
Soochow
Lanchow
Sian
Chingkiang
Nanking
Wuhu
Shanghai
Hangchow
Hankow
Hanyang
Shasi
Ichang
Chengtu
Chungking
Batang
Lhasa
Yunnanfu
Nanning
Canton
Hong Kong (Br.)
Swatow
Amoy
Foochow
Tainan
Hanoi
Haiphong
Hue
Tourane
Quinhone
Saigon
Pnompenh
Battambang
Bangkok
Ayudhya
Korat
Moulmein
Rangoon
Bassein
Mandalay
Dacca
Lingayen
Manila
Batangas
Brunei
Lake Baikal
Kosso-gol
Koko Nor
NAN-SHAN
Great Wall
Amur R.
Sungari R.
Kerulen R.
Selenga
Hwang R.
Grand Canal
Han R.
Yangtze R.
Si R.
Mekong R.
Menam R.
Salween
Irrawaddy
Brahmaputra R.
Yenisei R.
Argun R.
YABLONOI MTS.
KHINGAN MTS.
Railroad Supplies and Machinery
Beans, Bean Cake
Wool, Hides, Skins
Coal
Cotton Goods, Kerosene, Tobacco, Flour, Lumber, Machinery, Metals, Glass
Silk, Silk Goods, Tea, Dried Eggs
Silk
Tea
Cotton Goods, Kerosene, Tobacco, Flour, Lumber, Machinery, Metals, Glass
Silk, Matting, Fireworks, Hides, Skins, Europe; United States
Hemp, Tobacco, Copra, Europe; U.S.
Clothing, Machinery, Metal Goods, Europe; U.S.
Rice, Indo-China Sugar, U.S.
Rice, Teakwood To Japan
Rice, Europe; Nor. and Sou. America
Rice, To Europe; Teakwood, United States

PLATE XIX

N
O
P
1
2
3
4
5
6
118°
124°
14°
20°
26°
32°
38°
T I M O R S E A
I N D I A N O C E A N
MELVILLE
BATHURST I.
WESSEL'S IS.
Clarence Strait
Darwin
Pine Creek
Mataranka
Roper R.
Daly Waters
Cape Londonderry
Joseph Bonaparte Gulf
Wyndham
Cape Leveque
Derby
Broome
Fitzroy R.
N O R T H E R N
T E R R I T O R Y
Port Hedland
De Grey R.
Marble Bar
Great Sandy Desert
Roebourne
BARROW I.
N.W. Cape
Onslow
Fortescue R.
Ashburton R.
L. Dora
L. Blanche
L. Macdonald
Macdonnell Ranges
Alice Springs
Deep Well
L. Disappointment
Lake Amadeus
W E S T E R N
A U S T R A L I A
Carnarvon
Gascoyne R.
Shark Bay
DIRK HARTOG I.
Gladstone
Horseshoe
Lake Carnegie
L. Wells
Charlotte Waters
The Finke
Oodnadatta
Lake Eyre
Meekatharra
Nannine
L. Austin
Murchison R.
Sandstone
Laverton
L. Carey
Great Victoria Desert
S O U T H
A U S T R A L
Ajana
Yuna
Mt. Magnet
Salt L.
Leonora
L. Ballard
Malcolm
Mullewa
Geraldton
L. Barlee
Menzies
L. Raeside
Dongara
L. Moore
Kitchener
Haig
Forrest
Ooldea
Tarcoola
Wynbring
Hughes
Pimba
L. Everard
Penong
L. Gairdner
Kalgoorlie
Boulder
Coolgardie
Miling
Moora
L. Lefroy
L. Cowan
Merredin
Northam
Bruce Rock
Midland Jct.
York
Beverley
Johnston Lakes
Norseman
Perth
Fremantle
Newdegate
Ravensthorpe
Esperance
Narrogin
Collie
Bunbury
Katanning
Ongerup
Hopetoun
Augusta
Cape Leeuwin
Pemberton
Albany
Denmark
Ceduna
L. Acraman
Port Augusta
Buckleboo
Port Pirie
Wallaroo
Moonta
Mt. Hope
Cummins
Spencer's Gulf
Port Lincoln
Cape Catastrophe
Investigator Str.
St. Vincent G.
KANGAROO I.
G R E A T
A U S T R A L I A N
B I G H T
Copyright, The John C. Winston Co.
112°
118°
Longitude
124°
East
from
130°
Greenwich
136°


Q
R
S
T
PHYSICAL AND POLITICAL MAP OF AUSTRALIA AND NEW ZEALAND
SCALE OF MILES
0 100 200 300 400 500
State Capitals are underlined
State Boundaries
Railroads
REFERENCE
HEIGHT OF LAND
5000 feet
2000
1000
500
Sea Level
Below Sea Level
REFERENCE
CITIES
Less than 5,000
5,000 to 10,000
10,000 to 25,000
25,000 to 100,000
100,000 to 250,000
250,000 to 500,000
500,000 or over
148°
154°
160°
14°
20°
142°
154°
1
2
3
4
5
6
Torres Strait
Cape York
GULF OF CARPENTARIA
CORAL SEA
GREAT BARRIER REEF
WELLESLEY IS.
TROPIC OF CAPRICORN
PACIFIC OCEAN
QUEENSLAND
NEW SOUTH WALES
VICTORIA
TASMANIA
GREAT DIVIDING RANGE
Laura
Cooktown
Rumula
Cairns
Innisfail
Mt. Mulligan
Mungana
Burketown
Normanton
Croydon
Mt. Garnet
Forsayth
Ingham
Townsville
Dobbin
Cloncurry
Ballara
Charters Towers
Bowen
Richmond
Proserpine
Hughenden
Selwyn
Netherdale
Mackay
Sarina
Broad Sound
Dajarra
Winton
Aramac
Clermont
Longreach
Emerald
Barcaldine
Rockhampton
Jericho
Gladstone
Mt. Morgan
Blackall
Springsure
Many Peaks
Welford
Theodore
Thangool
Bundaberg
Sandy Cape
FRASER OR GREAT SANDY I.
Injune
Charleville
Quilpie
Mitchell
Juandah
Maryborough
Proston
Roma
Miles
Gympie
Nanango
Meandarra
Dalby
Toowoomba
Sandgate
Brisbane
Ipswich
Cunnamulla
Dirranbandi
Warwick
Mungindi
Lismore
Brewarrina
Walgett
Bourke
Moree
Glen Innes
Inverell
Grafton
Byrock
Narrabri
Barraba
Armidale
Terrowangee
Cobar
Nyngan
Coonamble
Tamworth
Kempsey
Broken Hill
Narromine
Dubbo
Ivanhoe
Condobolin
Parkes
Orange
Cessnock
Maitland
Newcastle
Hillston
Forbes
Kurri Kurri
Bathurst
Lithgow
Granville
Katoomba
Sydney
Liverpool
Bankstown
Wollongong
Hay
Temora
Cootamundra
Goulburn
Narrandera
Wagga Wagga
Canberra
Site of Federal Capital
Albury
Cooma
Mt. Kosciusko
Bombala
Cape Howe
Bairnsdale
Mildura
Balranald
Kulwin
Swan Hill
Kerang
Echuca
Bendigo
Shepparton
Castlemaine
Ballarat
Geelong
Melbourne
Wonthaggi
Port Albert
Warrnambool
Mt. Gambier
Hamilton
Ararat
Horsham
Adelaide
Murray Bridge
Victor Harbor
Kingston
Naracoorte
Beachport
Quorn
Peterborough
Gladstone
Marree
L. Blanche
Lake Frome
Lake Torrens
Bass Strait
KING I.
FLINDERS I.
CAPE BARREN I.
Banks Str.
Burnie
Devonport
Launceston
Zeehan
Longford
Queenstown
Bellerive
Hobart
Geeveston
S.E. Cape
176°
170°
40°
46°
North Cape
Russell
Whangarei
Hauraki Gulf
Helensville
Auckland
NORTH ISLAND
Tauranga
Bay of Plenty
East Cape
Hamilton
New Plymouth
Gisborne
Mt. Ruapehu
Hawke's Bay
Hastings
Napier
Wanganui
Palmerston
Woodville
C. Farewell
Tasman Bay
Nelson
Picton
Wellington
Westport
Blenheim
Cook Strait
C. Palliser
Greymouth
Hokitika
SOUTH ISLAND
Kaiapoi
Christchurch
Mt. Cook
Southern Alps
Timaru
Oamaru
Port Chalmers
Dunedin
Invercargill
STEWART I.
Foveaux Strait
South Cape
NEW ZEALAND
Same scale as main map


PHYSICAL MAP
OF
ASIA AND EUROPE
REFERENCE
HEIGHT OF LAND
12000 feet
6000 "
3000 "
1500 "
600 "
Sea Level
Below Sea Level
SCALE OF MILES
0 200 400 800 1200
Copyright, The John C. Winston Co.
Longitude East from Greenwich
EQUATOR
TROPIC OF CANCER
ARCTIC CIRCLE
A S I A
E U R O P E
AFRICA
AUSTRALIA
PACIFIC OCEAN
INDIAN OCEAN
ARCTIC OCEAN
ATLANTIC OCEAN
MEDITERRANEAN SEA
BERING SEA
Bering Strait
Sea of Okhotsk
JAPAN SEA
EAST CHINA SEA
Yellow Sea
SOUTH CHINA SEA
BAY OF BENGAL
ARABIAN SEA
RED SEA
Persian Gulf
Gulf of Oman
Gulf of Aden
Black Sea
Caspian Sea
Aral Sea
Baltic Sea
North Sea
Kara Sea
EAST INDIES
Plateau of Tibet
Himalaya Mts.
Plateau of Mongolia
Desert of Gobi
Altai Mts.
Plateau of Iran
Plateau of Arabia
Arabian Desert
Syrian Desert
Kirghiz Steppes
Ural Mts.
Caucasus Mts.
Elburz Mts.
Scandinavian Mts.
The Alps
Lowlands of India
Indian Peninsula
Plateau of Dekkan
Western Ghats
Eastern Ghats
Indo-China Peninsula
Malay Peninsula
Pen. of Asia Minor
Plains of China
Lake Baikal
Mt. Everest 29,141
Lena R.
Yenisei R.
Ob R.
Amur R.
Hwang
Yangtze
Mekong R.
Irrawaddy R.
Brahmaputra
Ganges R.
Indus R.
Sur Daria
Amu Daria
Tigris
Euphrates R.
Volga
Ural
NOVA ZEMBLA
North Cape
SAKHALIN
KARAFUTO
HOKKAIDO
HONSHU
KIUSHU
CHISMA IS.
ALEUTIAN IS.
Kamchatka Peninsula
Korea Pen.
Korea Strait
TAIWAN
LUZON
PHILIPPINE IS.
MINDANAO
BORNEO
CELEBES
SUMATRA
JAVA
TIMOR
PAPUA
CEYLON
SOKOTRA
C. Comorin
C. Guardaful
Bab-el-Mandeb Str.
Suez Canal
Strait of Malacca
Sunda Strait
Gulf of Siam
Mt. Sinai
Mt. Ararat
Empty Quarter
Dead Sea

Date Due

SEP 1 1 RETURN			

INTERNATIONAL PRESS